NOTICE

The drivers and utilities for Octagon products, previously provided on a CD, are now in a self-extracting zip file located at the Octagon Systems web site on the product-specific page. Download this file to a separate directory on your hard drive, then double click on it to extract the files. All references in this manual to files and directories on the CD now refer to files in the Utilities zip file.

4000 User's Manual

Doc. #04074 Rev. 0198

OCTAGON SYSTEMS CORPORATION®

6510 W. 91st Ave. Westminster, CO 80030
Tech. Support: 303–426–4521

COPYRIGHT

Copyright 1995, 1998—Octagon Systems Corporation. All rights reserved. However, any part of this document may be reproduced, provided that Octagon Systems Corporation is cited as the source. The contents of this manual and the specifications herein may change without notice.

TRADEMARKS

Micro PC™, PC SmartLink™, Octagon Systems Corporation®, the Octagon logo and the Micro PC logo are trademarks of Octagon Systems Corporation. QuickBASIC® is a registered trademark of Microsoft Corporation. ROM-DOS™ is a trademark of Datalight.

NOTICE TO USER

The information contained in this manual is believed to be correct. However, Octagon assumes no responsibility for any of the circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement. Octagon makes no representation or warranty that such applications will be suitable for the use specified without further testing or modification.

Octagon Systems Corporation general policy does not recommend the use of its products in life support applications where the failure or malfunction of a component may directly threaten life or injury. It is a Condition of Sale that the user of Octagon products in life support applications assumes all the risk of such use and indemnifies Octagon against all damage.

IMPORTANT!

Please read before installing your product.

Octagon's products are designed to be high in performance while consuming very little power. In order to maintain this advantage, CMOS circuitry is used.

CMOS chips have specific needs and some special requirements that the user must be aware of. Read the following to help avoid damage to your card from the use of CMOS chips.

Using CMOS Circuitry in Industrial Control

Industrial computers originally used LSTTL circuits. Because many PC components are used in laptop computers, IC manufacturers are exclusively using CMOS technology. Both TTL and CMOS have failure mechanisms, but they are different. This section describes some of the common failures which are common to all manufacturers of CMOS equipment. However, much of the information has been put in the context of the Micro PC.

Octagon has developed a reliable database of customer-induced, field failures. The average MTBF of Micro PC cards exceeds 11 years, yet there are failures. Most failures have been identified as customer-induced, but there is a small percentage that cannot be identified. As expected, virtually all the failures occur when bringing up the first system. On subsequent systems, the failure rate drops dramatically.

- Approximately 20% of the returned cards are problem-free. These cards, typically, have the wrong jumper settings or the customer has problems with the software. This causes frustration for the customer and incurs a testing charge from Octagon.

- Of the remaining 80% of the cards, 90% of these cards fail due to customer misuse and accident. Customers often cannot pinpoint the cause of the misuse.

- Therefore, 72% of the returned cards are damaged through some type of misuse. Of the remaining 8%, Octagon is unable to determine the cause of the failure and repairs these cards at no charge if they are under warranty.

The most common failures on CPU cards are over voltage of the power supply, static discharge, and damage to the serial and parallel ports. On expansion cards, the most common failures are static discharge, over voltage of inputs, over current of outputs, and misuse of the CMOS circuitry with regards to power supply sequencing. In the case of the video cards, the most common failure is to miswire the card to the flat panel display. Miswiring can damage both the card and an expensive display.

- **Multiple component failures** - The chance of a random component failure is very rare since the average MTBF of an Octagon card is greater than 11 years. In a 7 year study,

Octagon has never found a single case where multiple IC failures were not caused by misuse or accident. It is very probable that multiple component failures indicate that they were user-induced.

- **Testing "dead" cards** - For a card that is "completely nonfunctional", there is a simple test to determine accidental over voltage, reverse voltage or other "forced" current situations. Unplug the card from the bus and remove all cables. Using an ordinary digital ohmmeter on the 2,000 ohm scale, measure the resistance between power and ground. Record this number. Reverse the ohmmeter leads and measure the resistance again. If the ratio of the resistances is 2:1 or greater, fault conditions most likely have occurred. A common cause is miswiring the power supply.

- **Improper power causes catastrophic failure** - If a card has had reverse polarity or high voltage applied, replacing a failed component is not an adequate fix. Other components probably have been partially damaged or a failure mechanism has been induced. Therefore, a failure will probably occur in the future. For such cards, Octagon highly recommends that these cards be replaced.

- **Other over-voltage symptoms** - In over-voltage situations, the programmable logic devices, EPROMs and CPU chips, usually fail in this order. The failed device may be hot to the touch. It is usually the case that only one IC will be overheated at a time.

- **Power sequencing** - The major failure of I/O chips is caused by the external application of input voltage while the Micro PC power is off. If you apply 5V to the input of a TTL chip with the power off, nothing will happen. Applying a 5V input to a CMOS card will cause the current to flow through the input and out the 5V power pin. This current attempts to power up the card. Most inputs are rated at 25 mA maximum. When this is exceeded, the chip may be damaged.

- **Failure on power-up** - Even when there is not enough current to destroy an input described above, the chip may be destroyed when the power to the card is applied. This is due to the fact that the input current biases the IC so that it acts as a forward biased diode on power-up. This type of failure is typical on serial interface chips.

- **Serial and parallel** - Customers sometimes connect the serial and printer devices to the Micro PC while the power is off. This can cause the failure mentioned in the above section, *Failure upon power-up*. Even if they are connected with the Micro PC on, there can be another failure mechanism. Some serial and printer devices do not share the same power (AC) grounding. The leakage can cause the serial or parallel signals to be 20-40V above the Micro PC ground, thus, damaging the ports as they are plugged in. This would not be a problem if the ground pin is connected first, but there is no guarantee of this. Damage to the printer port chip will cause the serial ports to fail as they share the same chip.

- **Hot insertion** - Plugging cards into the card cage with the power on will usually not cause a problem. (**Octagon urges that you do not do this!**) However, the card may be damaged if the right sequence of pins contacts as the card is pushed into the socket. This usually damages bus driver chips and they may become hot when the power is applied. This is one of the most common failures of expansion cards.

- **Using desktop PC power supplies** - Occasionally, a customer will use a regular desktop PC power supply when bringing up a system. Most of these are rated at 5V at 20A or more. Switching supplies usually require a 20% load to operate properly. This means 4A or more. Since a typical Micro PC system takes less than 2A, the supply does not regulate properly. Customers have reported that the output can drift up to 7V and/or with 7-8V voltage spikes. Unless a scope is connected, you may not see these transients.

- **Terminated backplanes** - Some customers try to use Micro PC cards in backplanes that have resistor/capacitor termination networks. CMOS cards cannot be used with termination networks. Generally, the cards will function erratically or the bus drivers may fail due to excessive output currents.

- **Excessive signal lead lengths** - Another source of failure that was identified years ago at Octagon was excessive lead lengths on digital inputs. Long leads act as an antenna to pick up noise. They can also act as unterminated transmission lines. When 5V is switch onto a line, it creates a transient waveform. Octagon has seen submicrosecond pulses of 8V or more. The solution is to place a capacitor, for example 0.1 µF, across the switch contact. This will also eliminate radio frequency and other high frequency pickup.

TABLE OF CONTENTS

PREFACE 1

Conventions Used in This Manual 1
Symbols and Terminology 2
Technical Support 4

CHAPTER 1: OVERVIEW 5

Description 5
Major Features 5
Where To Go From Here: 7

CHAPTER 2: QUICK START 9

Hardware Installation 9
    Using a Micro PC Card Cage 10
    Panel Mounting or Stacking the 4000 13
    Using the 4000 in a Passive Backplane 16
Establishing Communications with the 4000 18
Transferring Files between 4000 & Your PC 19
    Downloading Files to the 4000 20

CHAPTER 3: EPROMS & BATTERY BACKUP 23

Description 23
SSD1 23
    To Install an EPROM 23
SSD2 24
    To Install Battery Backup for SSD2, Calendar Clock, and GPS Module 25
DRAM 25

CHAPTER 4: SETUP 27

Description 27
Running SETUP 28
SETUP Example 32

CHAPTER 5: SAVE & RUN PROGRAMS 33

Save and Run Your Programs on the 4000 33
Saving Program and Support Files 33
Autoexecuting Your Program 36
Overriding Program Autoexecution from SSD1 36

Running SETUP Again 37
Removing Jumper W2[3–4] 38

CHAPTER 6: SERIAL PORTS 39

Description 39
COM1 as Console I/O 40
COM1 as RS–232 I/O 41
Disabling Interrupts 41
Using QuickBASIC to Communicate Via COM1 41
Systems with a video card 42
Systems without a video card 42
Using Turbo C 44

CHAPTER 7: GPS INTERFACE 45

Description 45
Mounting the GPS Module 47
Installing the GPS module 47

CHAPTER 8: WATCHDOG TIMER, POWERFAIL & RESET 49

Watchdog Timer 49
Enhanced INT 17H Function Definitions 49
Enable Watchdog 49
Strobe Watchdog 50
Disable Watchdog 51
Powerfail 51
Hardware Reset 52
Remote Reset 52

CHAPTER 9: LPT1 PARALLEL PORT 53

Description 53
Printer 54
Display 54
Keypad 54
Opto Rack 55

CHAPTER 10: SERIAL EEPROM 57

Description 57
Enhanced INT 17H Function Definitions 57

Read Single Word from Serial EEPROM 57
Write Single Word to Serial EEPROM 58
Read Multiple Words from Serial EEPROM 59
Write Multiple Words to Serial EEPROM 60
Return Serial EEPROM Size 61

CHAPTER 11: VIDEO/KEYBOARD/SPEAKER 63

Description 63
Using a Video Monitor and Keyboard 64
Saving a Program to the 4000 64
Transferring Files to the 4000 65
Transferring Files from the 4000 66

CHAPTER 12: PC/104 67

CHAPTER 13: EXTERNAL DRIVES 69

Description 69
Floppy Disk Drives 69
Hard Disk Drive 70

CHAPTER 14: USING YOUR OWN DOS 73

Description 73
Getting Started 73
Selecting Boot, Memory, and Drive Options 74
Booting the 4000 from a Floppy/Hard Disk Drive 74
Booting from SSD1 with/without a Floppy Drive 75

CHAPTER 15: USER-DEFINED JUMPER 77

Enhanced INT 17H Function Definitions 77
Read Jumpers 77

CHAPTER 16: CPU POWER MANAGEMENT 79

Description 79
SLEEP.COM 79
SLOW.COM 80
Implementation 80
Advanced Power Management TSR 80

CHAPTER 17: TROUBLESHOOTING 81

Technical Assistance 84

CHAPTER 18: TECHNICAL DATA 85

Technical Specifications 85
Jumper Settings 89
Connector Pinouts 91
Micro PC Bus Pinouts 96

APPENDIX A: SOFTWARE UTILITIES 99

Introduction 99
COM1CON.COM 100
DISKSAVE.EXE 101
DISKSEND.EXE 104
FAST.COM 106
FMTSSD.EXE 107
LPT1CON.COM 108
RESET.COM 109
SETUP.COM 110
SLEEP.COM 112
SLOW.COM 113
SSDDRIVE.SYS 114
TRANSFER.EXE 117
VDISK.SYS 120

APPENDIX B: TIPS 123

Programming Standard EPROMs 123
Custom Communication Cable 123
Power Supply 124
Uploading Files from the 4000 125
Assigning Drive Designators 125
    Example 126
Extended Memory 127
Interrupts 128
    Remote Interrupt 129
    Disabling Interrupts 130

WARRANTY

PREFACE

This manual provides all the information required to install, configure, and operate the 4000 Micro PC Control Card. It is part of Octagon's Micro PC user manual series. To receive the Micro PC User Manual Binder, please return the reply card included with your Control Card.

By using this manual, you will be able to:

- Interface the 4000 Control Card to your PC and the Micro PC expansion cards.
- Set up communications between the 4000 card and a PC.
- Gain an understanding of the operation and various options allowed in the 4000 Control Card.

CONVENTIONS USED IN THIS MANUAL

1. Information which appears on your screen is shown in a different type face, for example:

   ```
   Octagon 4000-386-25MHz-1MB BIOS Vers x.xx
   Copyright (c) 1995 Octagon Systems, Corp. (TM)
   All Rights Reserved.
   ```

2. Commands that you must key in are shown in **Courier Bold**, for example:

   C:> **RESET**

3. Italicized refers to information that is specific to your particular system or program, e.g.,

   Enter *filename*

   means enter the name of your file.

4. Warnings always appear in this format:

   WARNING: The warning message appears here.

5. Paired angle brackets are used to indicate a specific key on your keyboard, e.g., <ESC> means the escape key; <CTRL> means the control key; <F1> means the F1 function key.

6. All addresses are given in hexadecimal.

SYMBOLS AND TERMINOLOGY

Throughout this manual, the following symbols and terminology are used:

W[–]	Denotes a jumper block and the pins to connect.
Autoexecution	Automatic execution of a program on power–up or reset.
BIOS drive	The solid–state disk which contains the system BIOS and ROM–DOS.
Console Port	Video card or COM1 where BIOS and DOS messages appear and keyboard input is available.
Control Card	Contains the CPU, memory, and operating system and controls the operation of all the extension cards.
DRAM	Dynamic Random Access Memory devices. DRAMs provide volatile memory with unlimited read and write cycles.
Expansion Card	The expansion cards add I/O functions to the Micro PC system, such as analog input/ output, digital input/output, motion control, display, and so on.
Flash memory	Electrically erasable PROM which allows at least 10,000 write cycles.
Memory device	The type of static RAM, DRAM, or flash memory specified for either volatile or nonvolatile memory.
PC SmartLINK	A serial communications software package designed by Octagon for use with the 4000 Control Card. Refers to all versions of PC SmartLINK.

ROM	Read Only Memory devices. ROMs provide nonvolatile memory, have a limited number of write cycles, and include EPROMs, EEPROMs, and flash memory.
ROM–DOS	Operating system included in Micro PC ROM.
Solid–State Disk (SSD)	A simulated disk using a high speed solid–state memory device, for example flash memory, EEPROM, or static RAM.
Static RAM	Static Random Access Memory device. Static RAMs provide volatile memory with unlimited read and write cycles. They may be used with a battery back–up module.
TTL Compatible	Transistor transistor logic compatible; 0–5V logic levels.
Virtual Drive	A disk created in DOS or extended memory which emulates an actual disk. Provides temporary storage for files. When power to the computer is turned off the virtual drive disappears.
XMODEM	A communications protocol which allows transfer of files between two computers.
XON/XOFF	A communications protocol for asynchronous connections. The receiver can pace the sender by sending the XOFF and XON characters to stop and continue the data flow.
H	The suffix “H” denotes a hexadecimal number. A decimal number has no prefix or suffix. For example, 1000H and 4096 are equivalent.

TECHNICAL SUPPORT

If you have a question about the 4000 Control Card and cannot find the answer in this manual, call Technical Support. They will be ready to give you the assistance you need.

When you call, please have the following at hand:

Your *4000 Control Card User's Manual*

A description of your problem.

The direct line to Technical Support is 303–426–4521.

DESCRIPTION

The 4000 is a low cost, single board PC for use in a wide variety of embedded applications. The 25 MHz 386SX processor has enough processing power for most control and data acquisition applications.

Despite its small size, the features include: DOS 6.22 in ROM; two serial ports; a parallel port; a watchdog timer; 1 MB of DRAM; 512K of flash memory with integral programmer or 1 MB of standard EPROM; keyboard and speaker ports; three solid–state disks; and ISA and 8/16–bit, PC/104 connectors.

The card can be used in a stand–alone mode or installed in a passive ISA bus backplane. For very small systems, one or two PC/104 expansion cards may be stacked on the 4000. The 4000 can also be installed in three or four slot card cages. Bus mastering is not supported on the 4000.

MAJOR FEATURES

Instant DOS

The 4000 is an "instant DOS" system. The card includes 6.22 compatible DOS in a solid–state disk. The system boots and operates the same way as your desktop PC.

Watchdog Timer

The watchdog timer resets the system if the program stops unexpectedly. The watchdog is enabled, disabled and strobed under software control. The timeout is 1.6 seconds (1.6 sec. typical, 1.00 sec. min., 2.25 sec. max.).

Calendar/Clock

The 4000 has a built–in, AT style calendar/clock. An external AT clock battery plugs into the card and powers the clock during power–down.

Solid–State Disk Options

SSD0 contains the BIOS and DOS 6.22 in ROM. SSD1 is used for storage of the applications program. 128K or 512K flash memory (5V) may be used. The flash memory programmer is built–in allowing reprogramming locally or through a serial port. Standard EPROMs up to 1 MB may also be used. SSD2 uses 128K or 512K SRAM soldered on card. The solid–state disks look like disks to the user. All the necessary software is provided.

Speaker and Keyboard Port
The 4000 accepts any AT keyboard and has the small PS–2 style keyboard connector. The speaker port is a 3–pin connector for use with any external speaker from 8–50 ohms.

Mounting
There are several ways to mount the 4000:
1. Plug it directly into a Micro PC card cage.
2. Use the optional PC mounting bracket and plug it into any passive backplane.
3. Panel mount it using the four mounting holes. A screw terminal connector is used to supply the 5V power.
4. Stack it with other Micro PC cards.

COM1 and COM2 Serial Ports
COM1 and COM2 serial ports are 16C450 compatible. The baud rates are programmable from 150 to 115K baud. Both ports have a RS–232 interface. RS–232 voltages are generated on–card. The COM2 port can be jumper configured to support a Trimble SVeeSix GPS module.

LPT1 Bidirectional Parallel Port
The LPT1 bidirectional parallel port can be used for a printer port or for general purpose I/O. For embedded applications, an interface board and software are available to interface with a 4–line LCD display and a 16–position keypad. The port can also be connected to the MPB–16PC, a 16–position opto module rack for driving high current AC and DC loads.

Setup stored in serial EEPROM
The 4000 stores the setup information in nonvolatile EEPROM; as a result it is immune to battery or power failure (with the exception of time and date). The user can also store additional information in the EEPROM. Up to 1,892 bytes are available.

Powerfail
The 4000 can be configured to generate an NMI interrupt if power drops below a preset level. This allows you to save critical application data before power fails.

Hardware Reset
A hardware reset can be done by any of the following means: issuing the RESET command; cycling power; depressing the reset

switch; or by applying 5V across the opto isolated reset input (J10 [3-4]). A hardware reset insures complete reset of the system and all attached peripherals.

Boot sequence
A system can be configured to boot from the on–card, solid–state disk, floppy or hard disk.

Where to go from here:

Before you begin developing your application program for the 4000, we recommend you read Chapters 2–4. These chapters give instructions for hardware installation, downloading and saving your program, and autoexecuting your application.

Chapter 2 Quick Start	Covers the basics of setting up a 4000 system. This chapter describes how to install the 4000 into the card cage, how to establish a serial communications link with your PC and how to download files to the 4000.
Chapter 3 EPROMs & Battery Backup	Configuring and installing EPROMs. Also, installing the battery backup for SSD2, GPS and calendar clock.
Chapter 4 SETUP	Running the SETUP configuration program.
Chapter 5 Save & Run Programs	How to save your program files and autoexecute them from the 4000.
Chapter 6 Serial Ports	Using COM1 and COM2. Setting COM1 as the main console I/O for serial communications with your PC.
Chapter 7 GPS Interface	Installing and using the GPS interface.
Chapter 8 Watchdog Timer, Powerfail & Reset	Enabling the watchdog timer, configuring the powerfail NMI, and system reset.

Chapter 9 LPT1 Parallel Port	Using the LPT1 parallel port for a printer, display, keypad or opto rack.
Chapter 10 Serial EEPROM	How to read and write to the serial EEPROM.
Chapter 11 Video/Keyboard/Speaker	Configuring the 4000 with a video, keyboard and speaker.
Chapter 12 PC/104	Using a PC/104 module.
Chapter 13 External Drives	Configuring the 4000 with a floppy drive or hard drive.
Chapter 14 Using Your Own DOS	Configuring the 4000 with a version of DOS other than ROM–DOS.
Chapter 15 User-defined Jumper	Reading the user-defined jumper by code in your program.
Chapter 16 CPU Power Management	Using the SLEEP.COM and SLOW.COM as power management utilities.
Chapter 17 Troubleshooting	Problems encountered when using the 4000.
Chapter 18 Technical Data	Technical specifications, jumper configurations and connector pinouts.
Appendix A Software Utilities	Description and operation of software utility programs and device drivers.
Appendix B Tips	Using non–Octagon cables, programming EPROMs, uploading files from the 4000, assigning drive designators and using interrupts.

CHAPTER 2 QUICK START

This chapter covers the basics of setting up a 4000 system and tells you:

1. How to panel mount, stack or install the 4000 into the card cage;
2. How to set up a serial communications link between the 4000 and your PC; and
3. How to download files to the 4000 and run a program from the virtual drive.

WARNING: The 4000 may not be installed in a PC. These cards are designed to be independent CPU cards only, not accelerators or coprocessors.

HARDWARE INSTALLATION

Your 4000 Control Card can be installed in one of several ways:

1. Plug it directly into a Micro PC card cage;
2. Panel mount it using the four mounting holes;
3. Stack it with other Micro PC cards;
4. Use the optional PC mounting bracket and plug it into any passive backplane.

Figure 2-1 provides a component diagram of the 4000. Refer to it as needed.

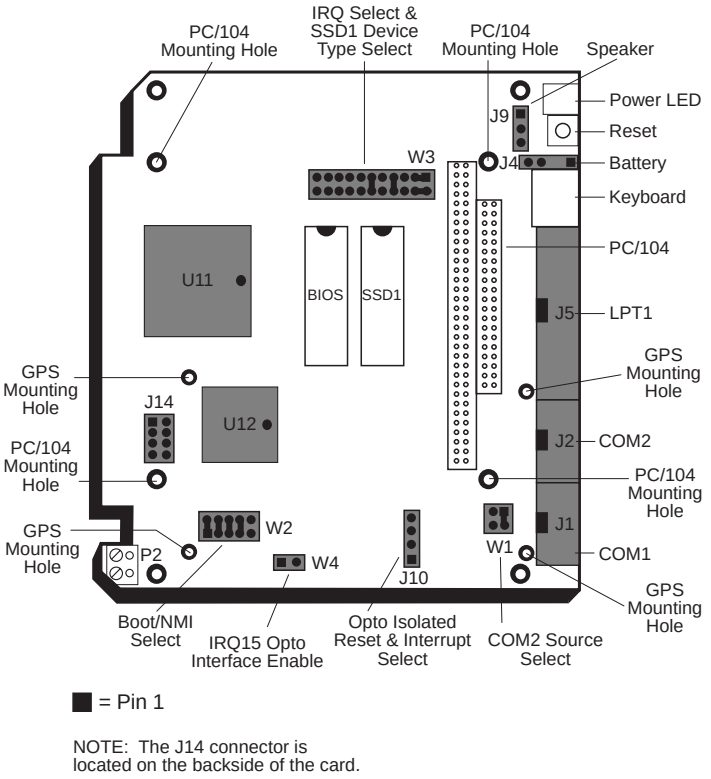

Figure 2-1 – 4000 Component Diagram

Using a Micro PC Card Cage

To install the 4000 in a Micro PC card cage, you will need the following equipment (or equivalent):

4000 Control Card
Micro PC Card Cage (520x Card Cage)
Power Module (510x Power Supply)
VTC–9F Cable
Null modem adapter
4000 ROM–DOS & Utility Software Disk
PC SmartLINK w/manual
Your PC

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

To install the 4000:

1. Refer to Figure 2-1 for the location of various connectors before installing the 4000 Control Card.

WARNING: The 4000 Control Card contains static–sensitive CMOS components. The greatest danger occurs when the card is plugged into a card cage. The 4000 card becomes charged by the user, and the static discharges to the backplane from the pin closest to the card connector. If that pin happens to be an input pin, even TTL inputs may be damaged. To avoid damaging your card and its components:

- Ground yourself before handling the 4000 card.
- Disconnect power before removing or inserting the card.
- When programming a memory device, place the device in the socket before applying power.

Take care to correctly position the 4000 card in the card cage. The VCC and ground signals must match those on the backplane. Figure 2-2 shows the relative positions of the 4000 card as it is installed in the card cage.

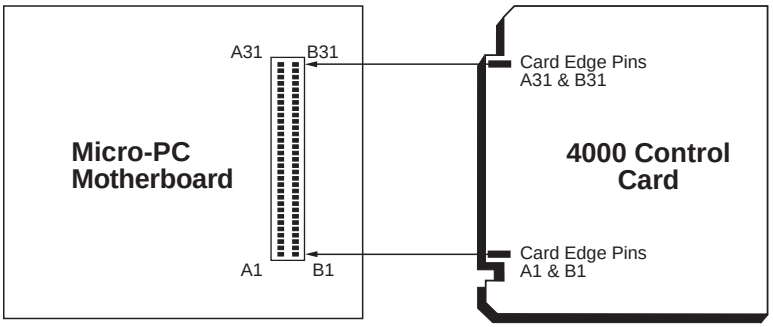

Figure 2-2 – Edge Connector Orientation

2. Attach the power module to the card cage following the instructions supplied with the power module.

3. Make sure power to the card cage is OFF.

4. Slide the 4000 into the card cage. The ROM–BIOS label on the card should face to the left or up depending on the type of card cage. See Figure 2-3 for an illustration of the 4000 in a Micro PC card cage.

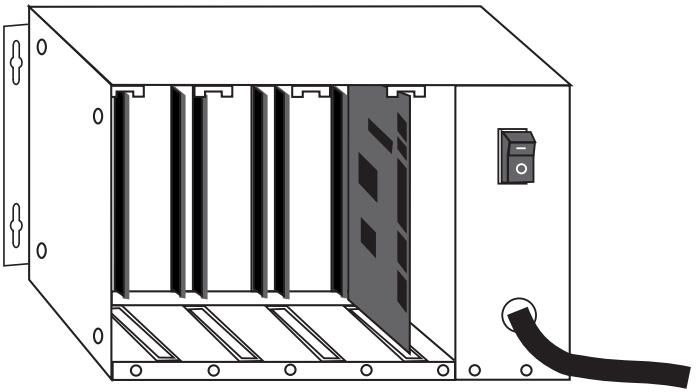

Figure 2-3 — Populated Micro PC Card Cage

WARNING: Plugging the card in incorrectly will destroy the card!

5. Connect one end of a VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J1) on the 4000.

   NOTE: You must use COM1 on the 4000 in order to establish a serial communications link with your PC.

6. If your PC has a 9–pin serial connector, connect the null modem adapter to any serial port (COM1 – COM4) on your PC. If your PC has a 25–pin serial connector, attach a 9– to 25–pin adapter to your null modem adapter, then insert the matching end of the 9– to 25–pin adapter into the serial port. See Figure 2-4.

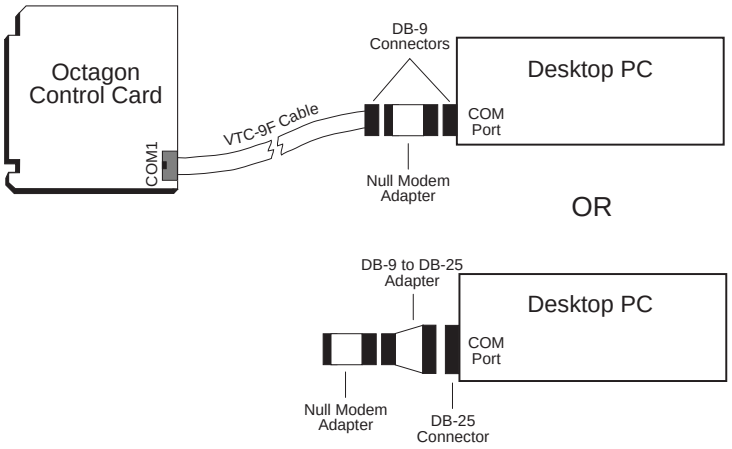

Figure 2-4 – Serial Communications Setup

NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

Panel Mounting or Stacking the 4000

To panel mount or stack the 4000, you will need the following equipment (or equivalent):

4000 Control Card
5V Power Supply
VTC–9F Cable
Null modem adapter
4000 ROM–DOS & Utility Software Disk
PC SmartLINK w/manual
Your PC

5252MB Stacking Kit (required for stacking only)

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

If you are panel mounting or stacking the 4000, a screw terminal connector (P2) is provided to supply the 5V power. Refer to Figure 2-5 for an illustration of panel mounting the 4000. Refer to Figure 2-6 for an illustration of stacking the 4000 with the 5252MB Stacking Kit.

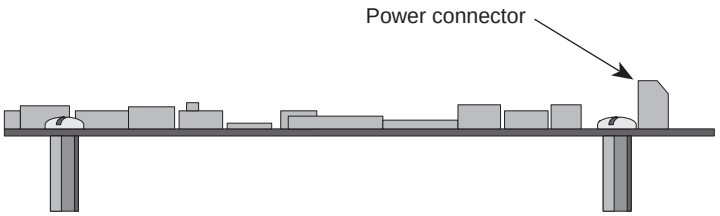

Figure 2-5 — Panel Mounting the 4000

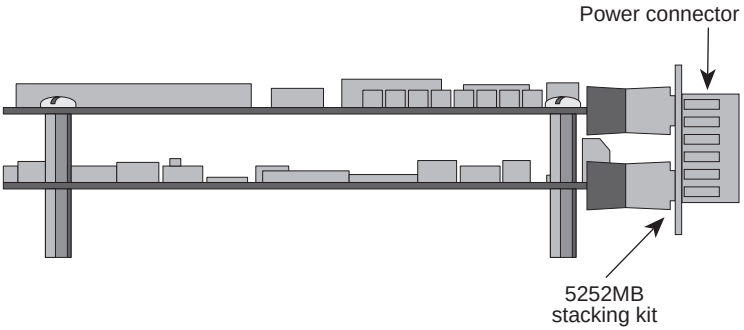

Figure 2-6 — Stacking the 4000

1. To panel mount the 4000, use #4–40 standoffs and screws to bolt down the card. The following diagram shows the center to center mounting hole dimensions.

   To stack the 4000, refer to the *5252MB Stacking Kit Product Sheet* enclosed with the kit. Then proceed with Step 2 in this section.

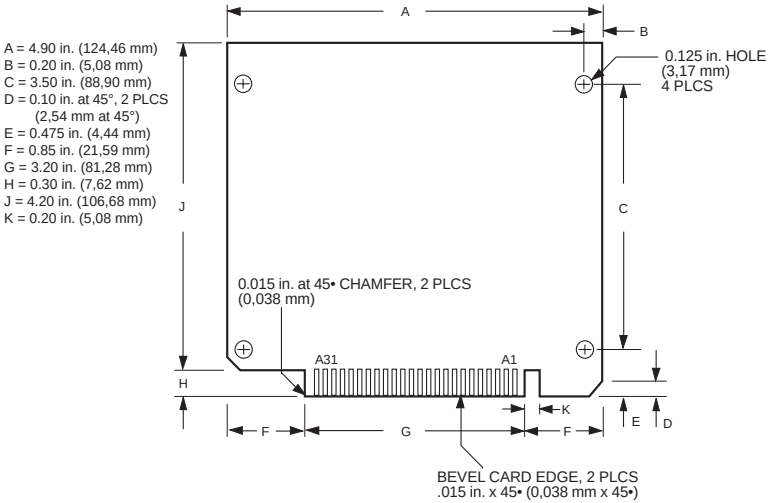

Figure 2-7 — 4000 Center to Center Hole Dimensions

2. Connect the proper ground and 5V wires to the terminal block at P2.

3. Connect one end of the VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J1) on the 4000.

   NOTE: You must use COM1 on the 4000 in order to establish a serial communications link with your PC.

4. If your PC has a 9–pin serial connector, connect the null modem adapter to any serial port (COM1 – COM4) on your PC. If your PC has a 25–pin serial connector, attach a 9–to 25–pin adapter to your null modem adapter, then insert the matching end of the 9– to 25–pin adapter into the serial port. See Figure 2-4.

   NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

You are now ready to transfer files between your PC and the 4000, please continue with the section, “Establishing Communications with the 4000” in this chapter.

Using the 4000 in a Passive Backplane

To plug the 4000 into a passive backplane, you will need the following equipment (or equivalent):

4000 Control Card
Micro PC Backplane (520x-BP)
Mounting Bracket (optional)
Power Module (510x Power Supply)
VTC–9F Cable
Null modem adapter
4000 ROM–DOS & Utility Software Disk
PC SmartLINK w/manual
Your PC

Please refer to Appendix B if you are making your own serial cable or using other non–Octagon components.

To install the 4000:

1. Make sure power to the card cage is OFF.

2. Insert the 4000 into a connector on the backplane. Take care to correctly position the card's edge with the connector of the backplane. Figure 2-2 shows the relative positions of the 4000 card as it is installed into a backplane.

   WARNING: Plugging the card in incorrectly will destroy the card!

3. Place the backplane on a flat surface so that the card is in an upright position. With the top of the card and its components facing left, attach the mounting bracket (optional) onto the edge nearest you. Secure the mounting bracket with the two screws provided in the kit. See Figure 2-8.

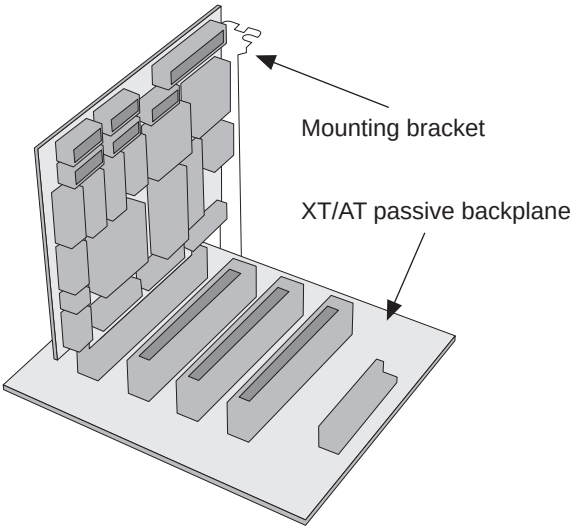

Figure 2-8 – Using a Passive Backplane

NOTE: The 4000 can drive up to three I/O cards.

4. Connect one end of a VTC–9F cable to the null modem adapter. Connect the other end to COM1 (J1) on the 4000.

   NOTE: You must use COM1 on the 4000 in order to establish a serial communications link with your PC.

5. If your PC has a 9–pin serial connector, connect the null modem adapter to any serial port (COM1 – COM4) on your PC. If your PC has a 25–pin serial connector, attach a 9– to 25–pin adapter to your null modem adapter, then insert the matching end of the 9– to 25–pin adapter into the serial port. See Figure 2-4.

   NOTE: Please refer to the PC SmartLINK manual for more information on using a COM port other than COM1.

ESTABLISHING COMMUNICATIONS WITH THE 4000

1. Install PC SmartLINK (or other communications software) on your PC if you have not already done so. Refer to the PC SmartLINK manual for installation instructions.

2. Copy the 4000 files from the 4000 utility disk to a subdirectory on your PC hard drive.

```
C:
MD C:\MPC
XCOPY A:\*.* C:\MPC /S
```

3. Start PC SmartLINK. You are now ready to establish communications between your PC and the 4000 Control Card.

4. Power on the 4000.

5. A logon message similar to the one below will appear on your PC monitor:

```
Octagon 4000-386-25MHz-1MB BIOS Vers. x.xx
Copyright (c)1995 Octagon Systems Corp. (TM)
All Rights Reserved
 640K BASE RAM
 380K SHADOW RAM
3070K EXTENDED RAM

Starting ROM-DOS...

HIMEM v6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.

VDISK v6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
    Extended memory present.

VDISK v6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
    Formatting 2880K XMS memory as drive C:
SSDDRIVE.SYS V1.00, SSD1 not found.
SSDDRIVE.SYS V1.00, assigning SSD2 (128KB) as drive E.

C:\> path C:\;D:\;
C:\> prompt 4000 $p$g
4000 C:\> showtime
Current date/time is: SAT 5/13/1995 9:44:05
4000 C:\>
```

If you do not get the proper logon message:

- Check the serial parameters of your PC to make sure they are set correctly. Parameters should be 9600 baud, 8 data bits, no parity, and 1 stop bit.
- Make sure a video card is not installed in the card cage.
- Make sure all jumpers are set to factory defaults.
- If the system still does not respond, refer to Chapter 17, *Troubleshooting*.

6. Use the directory command to make sure your equipment and software are working properly. Enter:

```
4000 C:\> DIR
```

A directory listing of ROM–DOS files stored in the BIOS socket should appear:

```
Volume in drive C is BIOS DRIVE
Volume Serial Number is 3250-16D4
Directory of C:\

COMMAND      COM   26321    04–17–95      6:22a
FAST         COM     358    05–05–95     10:59a
RESET        COM     370    05–05–95     10:59a
SETUP        COM    3897    05–05–95     10:59a
SHOWTIME     COM     619    05–05–95     10:59a
SLOW         COM     301    05–05–95     10:59a
DISKSAVE     EXE   22307    02-10-95      4:35p
TRANSFER     EXE    9969    01–05–93      2:36p
CONFIG       SYS     134    04–21-95      2:49p
HIMEM        SYS    2623    04-17-95      6:22a
SSDDRIVE     SYS    4478    05–05–95     10:59a
VDISK        SYS    4699    04-21-95      2:11p
AUTOEXEC   BAT     46      04-03-95       11:49a
    13 File(s)             76,179 bytes
                           0 bytes free
```

7. You are now ready to transfer files between your PC and the 4000.

TRANSFERRING FILES BETWEEN 4000 & YOUR PC

Once you have established communications between your PC and the 4000, you can download files to the virtual drive on the 4000. The virtual drive provides temporary storage for your files until you save them to a flash EPROM drive. The virtual drive also allows you to test and debug your application files before permanently saving them.

You can also upload files from your 4000 to your PC for editing and debugging. When booting from the BIOS drive, the VDISK.SYS driver allocates a virtual drive. The size of the virtual drive depends on the memory configuration of the 4000:

4000 Virtual Drives	
DRAM Installed	**Virtual Drive Size**
512K	136K uses VDISK.SYS 136 /NOTIFEXT*
1 MB	384K uses VDISK.SYS /E**
2 MB***	1024K uses VDISK.SYS /E**
4 MB***	3072K uses VDISK.SYS /E**

*This memory is taken out of DOS base memory.
**Size may be 64K smaller if DOS is loaded HIGH.
***Configurations with 2 MB or 4 MB have shadow RAM capability.

NOTE: The drivers are optional when booting from SSD1. For example, if you do not need a virtual drive with a 512K system, do not use VDISK.SYS.

A utility program called TRANSFER.EXE resides on the BIOS drive and is used to send or receive files via the serial port (e.g., COM1) on the 4000. TRANSFER.EXE uses the XMODEM protocol, as does PC SmartLINK. The following information on downloading files between the 4000 and your PC uses the example programs, DEMO.EXE and DEMO.BAS. These files are on your 4000 utility disk in the DEMO subdirectory.

Downloading Files to the 4000

The following procedures assume you are using PC SmartLINK and is included in your directory path. For other communication programs, refer to information on sending a file from your PC to the target system.

1. Log into the directory on your PC which contains the file(s) you will download to the 4000, for example:

   C:\MPC\4000\DEMO

2. Start PC SmartLINK and power on the 4000.

3. Execute the TRANSFER.EXE program from the 4000 by entering:

   ```
   4000 C:\> TRANSFER D:DEMO.EXE
   ```

   The following message displays:

   ```
   Receiving D:DEMO.EXE
   ```

4. Execute the following steps using PC SmartLINK:
   a. Press <ALT>+<D> to download a file.
   b. Type in the name of the file to transfer, e.g., C:\MPC\DEMO\DEMO.EXE.
   c. Press ENTER to start (default). The progress of the transfer displays in the dialog box.

   NOTE: Transfer will timeout if the program has not been started after approximately 40 seconds. It displays the following message:

   ```
   Failed to receive D:DEMO.EXE!
   Deleting D:DEMO.EXE
   ```

5. When the transfer is complete, type the following DOS command to view the virtual drive directory and confirm that your file has transferred to the 4000:

   ```
   4000 C:\> DIR D:
   ```

   The system will display the contents of drive D:

   ```
   Volume in drive D is VDISK vX.XX
   Directory of D:\
   DEMO      EXE    27264  01-01-80     2:57p
               1 file(s) 27264 bytes
   ```

6. To execute the program you have just downloaded type:

   ```
   4000 C:\> D:DEMO
   ```

7. The DEMO program displays a message on your PC.

This page intentionally left blank.

CHAPTER 3 EPROMs & BATTERY BACKUP

DESCRIPTION

Before you can save and boot your application from the 4000, you must first configure the system for your particular application requirements.

SSD1

SSD1 generally contains the program to be executed on power–up. The program is automatically loaded into DOS memory and executed. SSD1 accepts a 128K or 512K, 5V only, flash memory. Your application program can be saved to the flash memory using the on–card programmer. These devices are erased automatically during the programming process. You can write to the flash memory a limited number of times (about 100,000), if your application program requires changes.

When installed with the proper 5V flash, SSD1 can also be accessed directly as a read/write DOS drive when the SSDDRIVE.SYS driver is loaded. While this is convenient for product development, the flash memory, however, has a limited number of writes allowed. Therefore, Octagon does not recommend SSD1 be used as a data logging device. Use SSD2 instead, which is SRAM, for files that frequently change. Not all 5V flashes available work with SSDDRIVE.SYS in the read-write mode. Refer to Appendix A for information on supported flash devices and a description of SSDDRIVE.SYS.

Order Octagon P/N 4321: 512K 5V read/write memory.

You can also use a 512K (27C040) or 1 MB (27C080) standard EPROM for SSD1. These EPROMs must be programmed with an off–card programmer. Please refer to Appendix B for more information.

To Install an EPROM

1. Set the jumpers at W3 for the correct memory device:

W3: SSD1 Memory Device Select	
Pins Jumpered	**Description**
[1-3][2-4]*	Flash memory
[3-5][4-6]	EPROM

* = default

2. Install the EPROM into socket SSD1.

WARNING: When installing the chip, be sure to match the notch in the chip with the notch in the silkscreen. Incorrect installation will destroy the chip!

NOTE: Two types of flash memory are supported. One type can be used as a read/write drive and the other type can be used as a read-only drive. See the *SSDDRIVE.SYS* section in Appendix A for a list of supported flash memory and the listed type.

If installing a new flash memory that operates in a read/write mode, the new flash memory will be formatted to its maximum capacity on power-up and a message similar to "SSDDRIVE.SYS v1.00, assigning SSD1 (512KB) as drive E:" will be displayed. The SSD1 device is recognized as a disk drive and the size and drive designator are reported. Once the SSD1 device has been formatted and is recognized on power-up, it will not be formatted again. DISKSAVE.EXE is then used to make SSD1 a bootable device.

If installing a new flash memory that operates in a read only mode, DISKSAVE.EXE must be used to program the new flash memory. DISKSAVE.EXE is used to make a read only flash memory look like a bootable disk drive. SSDDRIVE.SYS will not recognize an unprogrammed EPROM and will display the message "SSDDRIVE.SYS v1.00, SSD1 not found."

For programming flash memory, see Chapter 5, *Save and Run Programs*, and *DISKSAVE.EXE*, *DISKSEND.EXE* and *SSDDRIVE.SYS* in Appendix A.

SSD2

SSD2 is a 128K (standard) or 512K (OEM contract) static RAM. A 3.6V AT clock battery can be used to battery back SSD2 via jumper block W3. SSD2 is recommended to be used as a read/write drive for files that change frequently, such as data logging files.

The 3.6V clock clock battery installed in J4 is used to battery back the calendar clock, GPS module, and can be used to battery back SSD2.

To Install Battery Backup for SSD2, Calendar Clock, and GPS Module

W3: SSD2 Battery Jumper	
Pins Jumpered	**Description**
[7-8]*	Battery backup for calendar/clock & GPS. No battery backup for SSD2.
[9-10]	Battery backup for calendar/clock, GPS & SSD2.

* = default

1. Install the 3.6V AT clock battery on the J4 connector. Refer to Figure 2-1 for the location of J4.

2. Jumper block W3[9-10] enables backup for SSD2.

DRAM

The 4000 is shipped with 1 MB of DRAM on card. OEM contract options for DRAM are 512K, 2 MB and 4 MB.

This page intentionally left blank.

DESCRIPTION

The SETUP program defines the 4000 system parameters. It is shipped with default configuration parameters stored in the serial EEPROM. Changes are made by running the SETUP program. The SETUP program is stored on the BIOS drive and on the 4000 utility disk.

4000 SETUP Parameters	Description	Default
COM1 Console Baud Rate	Specifies communications rate between your PC and the 4000 when no video card is in use.	9600
Power-on Memory Test	Extensive memory testing performed on bootup.	Enabled
SSD1 Device	Specifies the type of memory device installed in SSD1.	512K Flash EPROM
Boot from	Specifies the default boot drive.	BIOS drive using ROM-DOS
Number of Floppy Drives	Specifies the number of floppy drives attached.	0
Floppy Drive Size	Specifies size of the first floppy drive.	1.44 MB
Shadow 0C000H-0C7FF	The system will shadow copy ROM to DRAM and access DRAM in this memory region. This option is only available in systems with 2 MB or 4 MB of DRAM.	Yes
Shadow 0C800H-0CFFF	The system will shadow copy ROM to DRAM and access DRAM in this memory region. This option is only available in systems with 2 MB or 4 MB of DRAM.	Yes
Number of line printers	System will automatically check to verify if line printer port(s) exist.	Auto check
Number of hard drives	Specifies the number of hard drives attached.	0
Drive 0 parameters	Specifies the cylinders, heads and sectors of drive 1.	Varies with each drive

If you are running SETUP for the first time and have not previously saved and autoexecuted your program, we recommend you keep the default setting, "Boot from: BIOS drive using ROM–DOS". The 4000 continues to boot from the BIOS drive allowing you to verify your program files are successfully saved to SSD1. You can also test your program before setting the system to boot from your AUTOEXEC.BAT file. Once your program is tested and verified, you can run SETUP to configure the system to autoexecute your program.

RUNNING SETUP

1. Make sure you have established a serial communications link between the 4000 and your PC.

2. Enter:

   ```
   4000 C:\> SETUP
   ```

   NOTE: If you are not booting from the BIOS drive, the drive designator may differ.

3. The system will display the 4000 setup parameters and available options. Select the option by pressing the space bar until the correct information appears, then press <ENTER>. Press <ESC> twice if you want to exit setup without saving your responses.

   - COM1 Console Baud Rate:
     1200
     2400
     4800
     9600
     19200
     38400
     57600
     115200

     The following messages may appear:

NOTE: To use COM1 as the console at a speed other than 9600 baud, you must install the BIOS boot jumper. (W2[3–4])

- Power on memory test:
  Enabled
  Disabled

You may want to disable the memory test to speed up the boot process. You may also press any key to cancel the memory test while in progress.

- SSD1 device:
  128K 5V FLASH (29F010/29C010/29EE010)
  512K 5V FLASH (29F040/29C040/28SF040)
  EPROM (27C0x0)
  None

NOTE: After setting the SSD1 device, use DISKSAVE/ DISKSEND to program the flash memory.

NOTE: If SSD1 is not programmed, SSDDRIVE.SYS displays the message "SSD1 not found" when the system comes up.

- Boot from:
  BIOS drive using ROM–DOS
  SSD1 using ROM–DOS
  Floppy or Hard drive
  SSD1 using User supplied DOS/OS

NOTE: If NONE was selected for the SSD1 device type, the SSD1 boot options are not available.

We recommend that you do not change this option until you have saved and verified your program files in SSD1. If booting from the BIOS drive, the No Video jumper, W2[1–2], is ignored. If the BIOS boot jumper, W2[3–4], is not installed and you selected an option other than “Boot From BIOS Drive Using ROM–DOS”, the following message appears:

NOTE: To boot from the specified device you must install the BIOS boot jumper. (W2[3-4])

- Number of floppy drives:
  0, 1, 2

A maximum of 1 floppy drive is possible if booting from SSD1 and using your own DOS. See Chapter 14, *Using Your Own DOS* for details. The following message will appear if you select one floppy disk and you boot from SSD1 with your own DOS:

NOTE: Connect the floppy to the second floppy cable connector. The drive will be known as B:

- Floppy drive 1 size:
  360K
  1.2 MB
  720K
  1.44 MB

- Floppy drive 2 size:
  360K
  1.2 MB
  720K
  1.44 MB

These two options only display if you have specified that a floppy drive(s) is attached to the 4000.

- Shadow 0C000H–0C7FFH
  Yes
  No

This address is usually reserved for the video BIOS.

- Shadow 0C800H–0CFFFH
  Yes
  No

This address is usually reserved for network cards, SCSI controllers, etc.

The system defaults to shadowing RAM which enhances performance. However, some peripheral cards require access to RAM at these locations. Please refer to your peripheral card manual for specific information regarding RAM address locations.

NOTE: The shadow RAM options are NOT available on 512K or 1 MB DRAM systems.

- Number of line printers:
  - Auto Check
  - 0
  - 1
  - 2
  - 3

If you select Auto Check, the system automatically checks the available parallel printer interfaces to verify their existence by writing a pattern to the printer data lines during boot–up or reset. If you have a non–printing device attached to the LPT1 port, e.g., MPB–16PC and do not want data written to that port during boot–up, deselect the Auto Check option.

- Number of hard drives
  - 0
  - 1
  - 2

- Drive 0 parameters
  - Cylinders (xxx):
  - Heads (x):
  - Sectors (xx):

```
Press ENTER to SAVE the changes or
Press ESC to EXIT without saving the changes.
Saving options.
Options saved.
```

Depending on the options you have selected, the system may display the following message:

```
You must reset for these options to take effect.
```

SETUP EXAMPLE

The following example configures a system with 512K flash memory in SSD1, no memory test, 9600 baud, and booting from SSD1 with ROM–DOS:

```
OCTAGON SYSTEMS CORPORATION
4000 SETUP UTILITY V3.90
(Press SPACE to CHANGE, ENTER to ACCEPT, ESC to
EXIT)

COM1 Console Baud Rate:  9600
Power on memory test:  Disabled
SSD1 device: 512K 5V FLASH (29F040/29C040/28SF040)
Boot from:  SSD1 using ROM–DOS
Number of floppy drives: 0
Shadow 0C000H–0C7FFH:  Yes
Shadow 0C800H–0CFFFH:  Yes
Number of line printers:  Auto check
Number of hard drives: 0

Press ENTER to SAVE the changes or
Press ESC to EXIT without saving the changes.
Saving options.
Options Saved.
You must reset for these options to take effect.
4000 C:\>
```

NOTE: Executing SETUP /D will change all setup parameters to default values.

CHAPTER 5 SAVE & RUN PROGRAMS

SAVE AND RUN YOUR PROGRAMS ON THE 4000

Once you have written, tested and debugged your application, you can then save it to either battery–backed static RAM or flash memory in SSD1. When you reboot the 4000, your program can automatically load into DOS memory and execute.

This chapter tells you:

1. How to save an application program to SSD1;
2. How to autoexecute the program from the 4000; and
3. How to override autoexecution of your program.

The information in this chapter assumes you will be using ROM–DOS in your application. Some Microsoft programs make undocumented DOS calls. With ROM–DOS, an error will be returned when an undocumented DOS call is made, causing your program to operate erratically. We recommend booting from SSD1, using your own DOS, when using programs with undocumented DOS calls. Refer to Chapter 14, *Using Your Own DOS* for more information on saving and autoexecuting programs.

This chapter also assumes you will be using the 4000 without a video card/monitor. If you are using these devices, refer to Chapter 11, *Video/Keyboard/Speaker* for more information on transferring and saving programs.

SAVING PROGRAM AND SUPPORT FILES

In addition to your application program, you must also transfer support files to the 4000 to ensure proper operation. These files include the ROM–DOS COMMAND.COM, AUTOEXEC.BAT, CONFIG.SYS, and other files specific to your application. ROM–DOS COMMAND.COM is required to boot the 4000 with ROM–DOS from SSD1. AUTOEXEC.BAT defines the routine for autoexecution of your program.

CONFIG.SYS defines the various device drivers of your 4000 system. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4000. Each of these device drivers is discussed in greater detail in Appendix A, *Software Utilities*. Refer to Appendix B for more information on how the 4000 assigns drive designators.

`DEVICE=SSDDRIVE.SYS SSD1`	Accesses the SSD1 drive
`DEVICE=SSDDRIVE.SYS SSD2`	Accesses the SSD2 drive
`DEVICE=SSDDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=VDISK.SYS /E`	Accesses the virtual drive in extended memory
`DEVICE=VDISK.SYS 136`	Accesses a virtual drive in DOS base memory

NOTE: We recommend you include in your CONFIG.SYS file the entry DEVICE=SSDDRIVE.SYS BIOS. This allows you to easily access utility programs (SETUP, TRANSFER, etc.) that are located on the BIOS drive.

To Save Files to the 4000 SSD1

The following information leads you through transferring, saving and autoexecuting a program using the DEMO application and a flash memory in SSD1. All the files for this application are located on the 4000 utility disk in the DEMO directory. The two programs, DISKSAVE and DISKSEND, transfer and save the files on the floppy disk to SSD1. The DISKSAVE program resides on the BIOS drive of the 4000 and the DISKSEND program resides on the 4000 utility disk. The following procedures assume you are using PC SmartLINK.

1. Do an XCOPY of the utility disk to your hard drive. This will copy all subdirectories on the utility disk.

   ```
   MD C:\MPC
   XCOPY A:\*.* C:\MPC /S
   ```

2. Change to the 4000 directory to allow access to DISKSEND:

   ```
   CD \MPC\4000
   ```

3. Connect a VTC-9F serial cable and a null modem adapter between COM1 on the 4000 to a COM port on your PC. See Figure 2-4.

4. Start PC SmartLINK and power on the 4000.

   NOTE: If you are using PC SmartLINK from COM2 on your PC, you must use the /C2 switch with DISKSEND. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud, use the /Bxxx switch on both DISKSAVE and DISKSEND.

5. On the 4000, execute the DISKSAVE program by typing:

   ```
   4000 C:\> DISKSAVE /X /DSSD1
   ```

   The systems displays the following message:

   ```
   Attempting connection with DISKSEND on remote
   host.
   ```

6. Exit to DOS and type the following:

   ```
   DISKSEND \MPC\DEMO
   ```

   The system then erases and programs the flash memory. This may take several minutes.

7. Restart PC SmartLINK.

8. Confirm that the “Boot from” option in SETUP shows "BIOS drive with ROMDOS". Then type:

   ```
   4000 C:\> RESET
   ```

9. Display and verify the contents of SSD1:

   ```
   4000 C:\> DIR E:
   ```

10. Test run the DEMO program:

    ```
    4000 C:\> E:DEMO
    ```

11. If you want to boot from SSD1, run SETUP to specify this option.

AUTOEXECUTING YOUR PROGRAM

Once you have saved your program and other files to SSD1 you may boot from SSD1 and autoexecute your program.

1. Make sure jumper W2[3–4] is installed. (This is the default setting.)

2. Establish a serial communications link between your PC and the 4000.

3. Make sure the name of your application program is listed in the AUTOEXEC.BAT file, e.g., DEMO.

4. Run SETUP and specify "Boot from: SSD1 using ROM–DOS".

   ```
   4000 C:\> SETUP
   ```

5. Type:

   ```
   4000 C:\> RESET
   ```

   The 4000 will reset and boot from SSD1. SSD1 now becomes drive C.

OVERRING PROGRAM AUTOEXECUTION FROM SSD1

If you want to make changes to your program and need to override autoexecution of your program, you must reboot the 4000 from the BIOS drive. There are two options available:

1. You can rerun SETUP to change the "Boot from" option to "BIOS drive with ROM–DOS". If you include the line DEVICE=SSDDRIVE.SYS BIOS in your CONFIG.SYS file, you can access the SETUP program on the 4000 BIOS drive.

2. You can remove jumper W2[3–4]. However, this may be inconvenient and/or impossible if you are making program changes from an off–site location.

Running SETUP Again

1. Make sure you have established a serial link between your PC and the 4000.

2. To execute SETUP which is on the BIOS drive, type:

   ```
   4000 C:\> D:SETUP
   ```

   NOTE: The drive designator may vary depending on the hardware configuration of the 4000.

3. Select the “Boot from BIOS drive using ROM–DOS” option.

4. Enter:

   ```
   4000 C:\> D:RESET
   ```

5. Make the necessary changes to your application and copy the new files to a floppy disk, RAM disk, or directory.

6. Rerun DISKSEND and DISKSAVE to save your new files to SSD1. Verify and test your program.

7. Rerun SETUP to change the default boot drive to “SSD1 using ROM-DOS”.

8. Reset the 4000.

Removing Jumper W2[3–4]

If the SETUP program is not accessible from SSD1, you must remove jumper W2[3–4]. This configuration uses video and boots from the BIOS drive using ROM–DOS. COM1 is configured for 9600, N, 8, 1. The following message appears when you reboot the 4000:

```
BIOS boot jumper (W2[3–4]) not installed, boot-
ing from the BIOS drive and ignoring the video
jumper setting.
.
.
4000 C:\>
```

After booting from the BIOS drive, use the DISKSAVE and DISKSEND programs to download new files to SSD1. Before rebooting the 4000, be sure to reinstall jumper W2[3–4] if you want the 4000 to boot a device other than the BIOS drive.

DESCRIPTION

The 4000 has two serial ports that are Intel NS16C450 compatible. They can be used for interfacing to a printer, terminal or other serial device. These ports support 5–, 6– 7–, or 8–bit word lengths, 1, 1.5, or 2 stop bits, and baud rates up to 115.2K.

J1: COM1 and J2: COM2 Serial Ports		
Pin #	**COM1**	**COM2**
1	N.C.	N.C.
2	DSR	N.C.
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	N.C.	N.C.
8	N.C.	N.C.
9	Gnd	Gnd
10	+5V	+5V

* = active low

J1, J2 Serial Port, 10-pin Mating Connector:
Connector: Thomas & Betts 609-1030
Strain Relief: Thomas & Betts 609-1031

Use a VTC–9F cable to connect the ports to external serial equipment. The pinout of the connector allows you to plug the cable directly into a 9–pin PC serial connector. When interfacing the 4000 to your PC, you will need to use a null modem adapter.

COM1 AS CONSOLE I/O

The default settings for the 4000 are as follows:

- W2[1–2] — Video enabled
- W2[3–4] — Boot using parameters defined by SETUP

W2: COM1, Video and BIOS Boot Options		
Pins Jumpered	**Video System**	**Description**
[1-2][3-4]*	No video card installed in system.	Video over COM1. System will boot SETUP boot device
[1-2]		Video over COM1. System will boot BIOS drive.
[3-4]		No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡
[3-4]†	Video card installed in system.	Video on CRT. System will boot SETUP boot device.
[3-4] not jumpered†		Video on CRT. System will boot BIOS drive.

* = default

† = W2[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

NOTE: When W2[3–4] is removed, the baud rate defaults to 9600. If a video card is present, jumper W2[1–2] is ignored.

Some programs which access the video memory directly will not work properly on the 4000 without a video card resident. Refer to the DEMO.BAS program on the utility disk for an example of required QuickBASIC modifications. Refer to Chapter 11, *Video/Keyboard/Speaker* for more information on using a video as the console.

COM1 AS RS–232 I/O

When you have completed developing your application and programmed the 4000, you can use COM1 as an RS–232 serial port for connection to a printer, modem or other serial device. To access COM1 you have two options:

1. Configure the 4000 for no console port by removing jumper W2[1–2] and boot the system from SSD1 or floppy/hard drive (not the BIOS drive). If you do not remove W2[1–2], the BIOS sign on messages will be sent to your printer, modem or other device connected to COM1.
2. Add a video card and monitor to your 4000 system.

Use a VTC–9F cable to connect the ports to external serial equipment. The pinout of the connector allows you to plug the cable directly into a 9–pin PC serial connector.

DISABLING INTERRUPTS

The PC Bus does not allow shared interrupts on the bus. You can, however, disable the COM1 and COM2 interrupts (IRQ4 and IRQ3) to allow for other devices which use these interrupts. If COM1 is the console, its interrupt (IRQ4) is in use. COM2 (IRQ3) is not used by the BIOS.

USING QUICKBASIC TO COMMUNICATE VIA COM1

Several programming languages including QuickBASIC V4.5 assume a video card is present, and for system speed reasons write directly to the video hardware. This can be a problem since many control applications require video output. The following discussion is directed at QuickBASIC, but the principles (not accessing the print routines which access the video memory directly) apply to many languages. There are several ways to use COM1 from QuickBASIC V4.5.

Systems with a video card

Add a video card to the system and open/close COM1 using the QuickBASIC OPEN/CLOSE commands.

Systems without a video card

WARNING: The system will lock if you use commands such as PRINT or PRINT USING. Because QuickBASIC writes directly to video memory, these commands are usually displayed on a monitor.

METHOD 1

The system display will not appear over COM1 while the BIOS boots.

1. Remove the video jumper W2[1–2].

2. Boot from a drive other than the BIOS drive, e.g. SSD1 with ROM–DOS.

3. Use QuickBASIC's OPEN/CLOSE/PRINT/INPUT commands to access COM1. The following is an example program using these commands:

```
OPEN "COM1:9600,N,8,1,BIN" FOR RANDOM AS #1
CRLF$=CHR$(13)+CHR$(10)
PRINT #1, "INPUT A STRING" + CRLF$
INPUT #1, A$
PRINT #1, CRLF$ + A$
CLOSE #1
```

   NOTE: All PRINT/PRINT USING/INPUT . . . commands MUST use the COM1 device number.

METHOD 2

1. Leave the video jumper W2[1–2] on.

2. Use QuickBASIC's OPEN/CLOSE/PRINT/INPUT commands to access COM1. After closing the device, manually restore the serial parameters. The following example assumes 9600, N, 8, 1 parameters:

```
OPEN"COM1:9600,N,8,1,BIN" FOR RANDOM AS #1
CRLF$ = CHR$(13) + CHR$(10)
PRINT #1, "INPUT A STRING" + CRLF$
INPUT #1, A$
PRINT #1, CRLF$ + A$
CLOSE #1
```

NOTE: All PRINT/PRINT USING/INPUT . . . commands MUST use the COM1 device number.

3. Restore the serial parameters by using a batch file specifying your program's name as the first line of the file and COM1CON as the last line of the file.

   For example, TEST.BAT may include the following to execute a user application named USECOM1:

   ```
   USECOM1
   COM1CON
   ```

   Execute TEST.BAT.

   COM1 will be used as a communication port by USECOM1, then COM1 is restored to a console port by COM1CON.

   NOTE: COM1CON is located on the 4000 Utilities diskette.

METHOD 3

1. Leave the video jumper W2[1–2] on.

2. Use the PRINTS, PRINTSL, KEYHIT$, INKEY2$ commands as found in the DEMO.BAS and DSQBTEST.BAS programs (included on the utility diskette). Unformatted string output and string input must be done manually.

NOTE: Programs written in this manner will also work with a video card present and therefore systems can be “debugged” on your PC.

METHOD 4

1. Use an off–the–shelf communications library.

2. This may require restoring the COM1 parameters similar to method 2, if the console video is expected after the QuickBASIC program terminates.

METHOD 5

1. Use COM2 instead of COM1. This is similar to Method 1, but you will still get the system displays over COM1.

Using Turbo C

If you need to restore the serial parameters after executing a C program, refer to the file COMTEST.CPP. This file can be downloaded from the Octagon bulletin board at (303) 427–5368 using 14400 baud, 8 data bits, no parity, 1 stop bit.

DESCRIPTION

The 4000 provides a Global Positioning System (GPS) interface to allow for a direct connection to an optional Trimble SVeeSix-CM2 or SVeeSix-CM3 GPS module. Contact Trimble Navigation at (800) 827-8000 for more information about Trimble GPS modules.

The RTC backup battery supports the GPS interface to maintain time, date, last known location and GPS almanac data. This allows for rapid time to first fix (warm start) upon system turn on. The pulse per second output of the Trimble SVeeSix module is not currently supported, but will be supported on future revisions of the 4000 card.

J14: GPS Port		
Pin #	**CM2 Function**	**CM3 Function**
1	VCC Antenna (+5V)	VCC Antenna (+5V)
2	VCC (+5V)	VCC (+5V)
3	TxD (TTL)	TxD (TTL)
4	Battery Backup	Battery Backup
5	RxD (TTL)	RxD (TTL)
6 (N.C.)	One pulse per second (TTL)	One pulse per second (TTL)
7	N.C.	RxD_DGPS (TTL)
8	Gnd	Gnd

The GPS interface shares the data transmit and receive connections with COM2 of the 4000. Hence, care must be taken when using the system with a GPS module installed. The following tables describe how the signals at J2 are changed depending upon the type of GPS module installed.

Mode: Nominal COM2 (no GPS installed) W1[1-2]		
Pin #	**COM2 Connector J2**	**Comment**
1	N.C.	
2	N.C.	
3	Rx	
4	RTS	Standard implementation
5	Tx	with Rx, Tx, RTS, and
6	CTS	CTS only.
7	N.C.	
8	N.C.	
9	Gnd	
10	+5V	

Mode: GPS CM2 or CM3 installed (differential GPS not activated) W1[1-3]		
Pin #	**COM2 Connector J2**	**Comment**
1	N.C.	
2	N.C.	
3	N.C.	GPS TxD ouput connected to UART RxD input via jumper
4	RTS	Monitor only, not used
5	Tx	Monitor only, commands from system to GPS
6	CTS	Not used, apply no signals
7	N.C.	
8	N.C.	
9	Gnd	
10	+5V	

Mode: GPS CM3 Installed (differential GPS active) W1[1-3, 2-4]		
Pin #	**COM2 Connector J2**	**Comment**
1	N.C.	
2	N.C.	
3	Rx_DGPS	Input from differential correction link, RS-232 levels
4	RTS	Monitor only, not used
5	Tx	Monitor only, command from system to GPS
6	CTS	Not used, apply no signals
7	N.C.	
8	N.C.	
9	Gnd	
10	+5V	

MOUNTING THE GPS MODULE

The Trimble GPS module mounts onto the 4000 card at the J14 connector. (See Figure 7-1.) To order the GPS Hardware Kit, call Octagon and order P/N 4079. The kit includes:

8-Pin, Female Connector (Qty 1)
Screws (Qty 8)
Washers (Qty 8)
Stand-offs (Qty 4)
Wire Strain Relief (Qty 1)
Cable Tie (Qty 1)

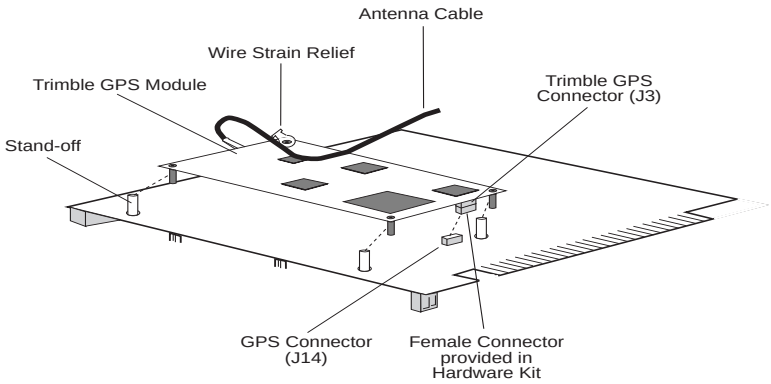

Figure 7-1 - Mounting the Trimble GPS Module onto the 4000

Installing the GPS module

WARNING: Verify that power to the 4000 card is OFF. Also, to avoid damaging your card, module and their components, ground yourself before handling the 4000 card or the GPS module.

Also, care should be exercised when mounting and removing the module to avoid damage to the GPS connector.

1. Attach the 8-pin female connector, provided in the GPS Hardware Kit, to the 8-pin male connector, J3, on the bottom side of the Trimble GPS module. Set the GPS module aside.

2. From the top of the 4000 card, insert a screw through a washer and then through one of the four GPS mounting holes. Refer to Figure 2-1 for the location of the GPS mounting holes on the 4000 card.

3. As you hold the screw/washer assembly in place, turn the 4000 card over and attach a stand-off. Tighten as necessary. Repeat Steps 2 and 3 for the remaining GPS mounting holes.

4. Align the J3 connector of the Trimble GPS module over the J14 connector of the 4000 card and mate the connectors together. Place the 4000/GPS assembly onto a flat surface.

5. Install the antenna cable strain relief provided in the GPS Hardware Kit. Insert a screw through a washer and then through the strain relief. Attach and tighten the strain relief assembly to the stand-off closest to the antenna cable connector, J1, on the Trimble GPS module.

6. Install a washer and screw in each of the remaining mounting holes of the GPS module. Tighten all screws as necessary.

7. Connect the GPS antenna cable to J1 on the Trimble GPS module. Secure the antenna cable to the antenna cable strain relief using the wire tie provided in the GPS Hardware Kit.

WATCHDOG TIMER

The watchdog timer is a fail-safe against program crashes or processor lockups. It times out every 1.6 seconds (1.6 sec. typical, 1.00 sec. min., 2.25 sec. max.) unless reset by the software. The address for the watchdog timer enable port is 380H. The timer is software disabled when you write a "0" to address 380H. This is the default setting on power–up or reset.

When you want to start using the watchdog timer, write a "1" to address 380H. You must write any data to 388H within the timeout period to prevent the board from resetting. When you write to 388H, the timer resets and begins counting down again. The following table lists the software enable and strobe information:

Watchdog Timer Software & Strobe Addresses	
Enable Base Address 380H	**Strobe Base Address 388H**
Timer disabled = 0* Timer enabled = 1	Write any data to this address to reset timer

* = default

ENHANCED INT 17H FUNCTION DEFINITIONS

This section provides definitions for the following functions: Enable Watchdog, Strobe Watchdog and Disable Watchdog.

Enable Watchdog

Function: fdh
Subfunction: 01h

Purpose: To enable the watchdog.

Calling Registers: AH fdh
AL 01h
DX ffffh

Return Registers: None

Comments: This function enables the watchdog. Once the watch dog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming Example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
        mov     ax,0fd01h
        mov     dx,0ffffh
        int     17h
    }
```

Strobe Watchdog

Function: fdh
Subfunction: 02h

Purpose: To strobe the watchdog.

Calling Registers: AH fdh
AL 02h
DX ffffh

Return Registers: None

Comments: This function strobes the watchdog. Once the watch dog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming Example:

```
/* Inline assembly code for Borland C++ 3.1 */
    asm {
            mov     ax,0fd02h
            mov     dx,0ffffh
            int     17h
        }
```

Disable Watchdog

Function: fdh
Subfunction: 03h

Purpose: To disable the watchdog.

Calling Registers: AH fdh
AL 03h
DX ffffh

Return Registers: None

Comments: This function disables the watchdog. Once the watch dog is enabled, it has to be strobed at a period of not less than 1.6 seconds or until the watchdog is disabled. Otherwise, a system reset will occur.

Programming Example:

```
/* Inline assembly code for Borland C++ 3.1 */
asm {
        mov     ax,0fd03h
        mov     dx,0ffffh
        int     17h
    }
```

POWERFAIL

The 4000 will generate an NMI interrupt if power drops below 4.75V. This allows you to save critical application data before power fails. The 4000 resets at 4.55V to 4.65V. The trip level monitors the on–card 5V supply.

W2: NMI Interrupt Source	
Pins Jumpered	**Description**
[7-8]*	Bus NMI
[9-10]	Power Fail NMI

* = default

If you are monitoring powerfail, you must set the jumper block W2. This selects the powerfail logic as the source of the NMI interrupt. Alternately, you can configure the 4000 to generate an NMI (-IOCHK) interrupt from the PC/104 interface should these devices require one.

You must install your own interrupt handler, such as a routine to respond to power fail, in response to the NMI interrupt. The default NMI interrupt handler will generate the message "PARITY ERROR 2" when the -IOCHK signal goes low or the power drops below 4.75V.

HARDWARE RESET

The 4000 has a button which allows you to reset the system without turning off the power. This provides a more complete reset than the <CTL><ALT><DEL> method. The RESET command also accomplishes the same thing as the reset button.

Remote Reset

In addition to the pushbutton reset, there is a separate opto–isolated input so that the 4000 can be remotely reset. The opto–isolation allows the reset line to extend up to 50 feet from the card. A 5V signal applied to the optical reset inputs (GND to J10-3, +5V to J10-4) will reset the system. Noise filtering is built–in. The isolation from the system ground is 500V. The remote reset is accessed at J10[3-4].

J10: Opto-Isolated Reset & Interrupt	
Pin #	**Signal**
1	+ IRQ
2	- IRQ
3	- Reset
4	+ Reset

J10 Opto-isolated Reset and Interrupt, 4-pin Mating Connector:
Connector housing: DuPont BERG #65039-033
Crimp terminals: DuPont BERG #48235-000

Refer to Appendix B for information on using the opto-isolated interrupt, J10[1-2].

DESCRIPTION

The LPT1 parallel port has a 26–pin connector. It can be used to support a number of devices including PC compatible printer, multiline display, matrix keypad or an opto rack with opto-isolated digital I/O modules.

J5: LPT1 Printer Port		
Pin #	**Function**	
1	Out	STB*
2	Out	AFD*
3	I/O	D0
4	In	ERR*
5	I/O	D1
6	Out	INIT*
7	I/O	D2
8	Out	SLIN*
9	I/O	D3
10	Gnd	Gnd
11	I/O	D4
12	Gnd	Gnd
13	I/O	D5
14	Gnd	Gnd
15	I/O	D6
16	Gnd	Gnd
17	I/O	D7
18	Gnd	Gnd
19	Out	ACK*
20	Gnd	Gnd
21	In	BUSY
22	Gnd	Gnd
23	In	PE
24	Gnd	Gnd
25	In	SLCT
26	+5	+5

* = active low

J5 Parallel Printer Port, 26-pin Mating Connector:
Connector: Thomas & Betts 609-2630
Strain Relief: Thomas & Betts 609-2631

PRINTER

To install a printer:

1. Connect an Octagon VTC–5/IBM cable from the LPT1 port (J5) to the 25–pin connector on your printer cable.

2. Connect the cable to your printer.

DISPLAY

The LPT1 port supports either 4x20 or 4x40 liquid crystal displays (LCD). To interface the displays to the 4000, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4000. The program DISPLAY.EXE (found on the 4000 utility disk) provides an easy method to use the display. Please refer to the file DISPLAY.DOC on the utility disk for information on initializing and using the display. Also, refer to the 2010 Product Sheet for information on the interface board. To install a display:

1. Connect a CMA–26 cable from the LPT1 port to J1 on the 2010.

2. Connect the display cable to either the 14–pin or 16–pin header on the 2010. The size of the display will determine which header to use.

3. Refer to the file DISPLAY.DOC for more information on initializing and using the display.

KEYPAD

LPT1 also supports 4x4 matrix keypads. To interface the keypad to the 4000, use the Octagon 2010 interface board. A CMA–26 cable is required to connect the interface board to the 4000. The program DISPLAY.EXE (found on the 4000 utility disk) provides an easy method to use the keypad. Refer to the file DISPLAY.DOC on the utility disk for information on initializing and using the keypad. Also, refer to the 2010 Product Sheet for information on the interface board. To install a keypad:

1. Connect a CMA–26 cable from the LPT1 port to J1 on the 2010.

2. Connect the keypad cable to the 10–pin header on the 2010.

3. Refer to the file DISPLAY.DOC for more information on reading the keypad.

OPTO RACK

The Octagon MPB-16PC opto rack interfaces directly to the parallel printer port and can control high voltage/high current G4 opto-isolated modules. Of the 16 positions available, 8 can be either input or output, four are dedicated as inputs and four are dedicated as outputs. Refer to the *MPB-16PC Opto Module Rack Product Sheet* for more information.

This page intentionally left blank.

CHAPTER 10 SERIAL EEPROM

DESCRIPTION

Up to 768 words of user-definable data can be saved in the serial EEPROM. The serial EEPROM does not require battery backup to maintain the data when the system power is off. The serial EEPROM is easily accessible via software interrupts by most programming languages. The software interrupt used is INT 17 subfunction 0FEH (read) and INT 17 subfunction 0FFH (write).

ENHANCED INT 17H FUNCTION DEFINITIONS

This section provides definitions for the following functions: Read Single Word from Serial EEPROM, Write Single Word to Serial EEPROM, Read Multiple Words from Serial EEPROM, Write Multiple Words to Serial EEPROM, and Return Serial EEPROM Size.

Read Single Word from Serial EEPROM

Function: fch
Subfunction: 00h

Purpose: To read a single word from the on-board serial EEPROM.

Calling Registers:
AH fch
AL 00h
BX Word address (zero based)
DX ffffh (user area relative address)

Return Registers:
Carry flag cleared if successful
AX Word read

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function reads a word from the user area of the serial EEPROM.

Programming Example:

```
/* Read word 2 */
unsigned int seeData;
/* Inline assembly code for Borland C++ 3.1 */
asm {
       mov     ax,0fc00h
       mov     bx,02h          /* Read word 2 */
       mov     dx,0ffffh
       int     17h
       mov     seeData,ax      /* store data in c
                                     environment */
    }
```

Write Single Word to Serial EEPROM

Function: fch
Subfunction: 01h

Purpose: To write a single word to the on-board serial EEPROM.

Calling Registers:

AH	fch
AL	01h
BX	Word address (zero based)
CX	Data word to write
DX	ffffh (user area relative address)

Return Registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function writes a word to the user area of the serial EEPROM.

Programming Example:

```
/* Write 0x1234 to word 3*/
unsigned int seeData = 0x1234;
/* Inline assembly code for Borland C++ 3.1 */
asm {
       mov     ax,0fc01h
       mov     bx,03h          /* Write word 3 */
       mov     cx,seeData      /* Get write data from
                                    c environment */
       mov     dx,0ffffh
       int     17h
    }
```

Read Multiple Words from Serial EEPROM

Function: fch
Subfunction: 02h

Purpose: To read multiple words from the on-board serial EEPROM.

Calling Registers:

AH	fch
AL	02h
BX	Word address (zero based)
CX	Word count
DX	ffffh (user area relative address)
ES:DI	Destination pointer

Return Registers: Carry flag cleared if successful

AX	Word read

Carry flag set if error

AL	Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function reads multiple words from the user area of the serial EEPROM.

Programming Example:

```
/* Read 10 words starting at word 5 */
unsigned int far *seeDataPtr = new unsigned int[10];
/* Allocate storage*/
/* Inline assembly code for Borland C++ 3.1 */
asm {
    mov     ax,0fc02h
    mov     bx,05h          /* Read starts at word 5 */
    mov     cx,10           /* Read 10 words */
    mov     dx,0ffffh
    les     di,seeDataPtr
    int     17h
    }
```

Write Multiple Words to Serial EEPROM

Function: fch
Subfunction: 03h

Purpose: To write multiple words to the on-board serial EEPROM.

Calling Registers:
AH fch
AL 03h
BX Word address (zero based)
CX Word count
DX ffffh (user area relative address)
DS:DI Source pointer

Return Registers: Carry flag cleared if successful

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function writes multiple words to the user area of the serial EEPROM.

Programming Example:

```
/* Write 8 words starting at word 6*/
    unsigned int far *seeDataPtr = new unsigned int[8];
/* Allocate storage*/
    unsigned int far* tmpPtr = seeDataPtr;
    for(int i=0;i<8;i++)
      *seeDataPtr = i;    /* initialize data */
/* Inline assembly code for Borland C++ 3.1 */
    asm {
           mov    ax,0fc03h
           mov    bx,06h         /* Write starts at
                                     word 6 */
           mov    cx,8           /* Write 8 words */
           mov    dx,0ffffh
           lds    si,seeDataPtr
           int    17h
        }
```

Return Serial EEPROM Size

Function: fch
Subfunction: 04h

Purpose: To obtain the size of the on-board serial EEPROM.

Calling Registers: AH fch
AL 04h
DX ffffh

Return Registers: Carry flag cleared if successful
AX Size of the serial EEPROM
BX Size available to user

Carry flag set if error
AL Error code

Error Code	Meaning
ffh	Unknown error
01h	Function not implemented
02h	Defective serial EEPROM
03h	Illegal access

Comments: This function returns the size of the serial EEPROM. Since the user cannot access all of the serial EEPROM, this function determines how much space is available to the user. This avoids the user from accessing unavailable address.

Programming Example:

```
unsigned int seeUserSize;
/* Inline assembly code for Borland C++ 3.1 */
asm {
       mov    ax,0fc04h
       mov    dx,0ffffh
       int    17h
       mov    seeUserSize,bx
    }
```

CHAPTER 11 VIDEO/KEYBOARD/SPEAKER

DESCRIPTION

You can use a video card with a monitor and a keyboard with the 4000 instead of using your PC keyboard and monitor over a serial communications link. The keyboard lines are brought out to a PS–2 type connector. Any PS–2 compatible keyboard may be used.

J3: Keyboard/ Port	
Pin #	**Function**
1	Keyboard data
2	NC
3	Gnd
4	+5V
5	Keyboard clock
6	NC

The speaker is interfaced via a 3–pin connector at J9. You may use any external speaker from 8–50 ohms. If an amplifier/speaker is used, Speaker Data, +5V and Gnd are supplied for the amplifier. If only a speaker is used, attach directly to Speaker Data and +5V.

J9: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

J9 Speaker, 3-pin Mating Connector:
Connector housing: DuPont BERG #65039-034
Crimp terminals: DuPont BERG #48235-000

USING A VIDEO MONITOR AND KEYBOARD

You will need the following equipment (or equivalent) to use your 4000 with a video and keyboard:

4000 PC Control Card
Micro PC Card Cage
Power Module
2430 PC/104 SVGA Module or 54xx Video Card and Monitor
AT Compatible Keyboard with PS–2 type Connector
VTC–9F Cable
Null Modem Adapter

1. Configure the 4000 for a video card by installing jumper W2[1–2]. Also configure the system to boot from the BIOS drive.

2. If using the 2430 PC/104 SVGA module, install the module onto the PC/104 interface of the 4000. If using the 54xx video card, install the video card into the card cage.

3. Install the 4000 into the card cage.

4. Connect the keyboard to J3 on the 4000 card.

5. Connect the video monitor to the video card.

6. Power on the 4000. The BIOS messages should appear on your video monitor:

```
Octagon 4000-386-25MHz-4MB BIOS Vers x.xx
Copyright (c) 1995 Octagon Systems, Corp. (TM)
All Rights Reserved
```

Saving a Program to the 4000

The following steps detail the procedures for transferring files to the 4000 and programming the flash memory in SSD1 using the DISKSEND and DISKSAVE programs. The DISKSAVE program resides on the BIOS drive of the 4000 and the DISKSEND program resides on the 4000 utility disk.

1. Do an XCOPY of the utility disk to your hard drive:

```
MD C:\MPC
XCOPY A:\*.* C:\MPC /S
```

2. Change to the 4000 directory to allow access to DISKSEND:

   CD \MPC\4000

3. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4000. Refer to Figure 2-4.

4. On the 4000, execute the DISKSAVE program by typing:

   4000 C:\> **DISKSAVE /DSSD1 /X**

5. From your PC, execute the DISKSEND program by typing:

   C:> **DISKSEND \MPC\DEMO**

   The system will then erase and program the flash memory. This will take several minutes.

Transferring Files to the 4000

The following steps detail the procedures for transferring files from your PC to the virtual drive on the 4000. In order to transfer files from your PC to the 4000, you must execute the TRANSFER program from both the 4000 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4000. Refer to Figure 2-4.

2. Execute the TRANSFER program from the 4000 to receive a file from your PC.

   4000 C:\> **TRANSFER /COM1 /R /V <drive>*filename.ext***

   <drive> is the virtual drive on the 4000 where the file will be transferred.

   filename.ext is the name of the file on the 4000 which you are receiving from your PC.

   /V enables “R” characters upon receiving a block and “T” upon transferring a block.

3. Execute the TRANSFER program from your PC to send a file to the 4000.

   C:>**TRANSFER /COM1 /S /V <drive><path>*filename.ext***

   filename.ext is the name of the file on the PC which you are sending to the 4000.

NOTE: Transfer will timeout if the program has not been started after approximately 40 seconds. It displays the following message:

```
Failed to receive <drive>filename.ext!
Deleting <drive>filename.ext
```

Also, you may speed up the transfer using the /Bnnnn switch to increase the baud rate. Example: /B57600.

Transferring Files from the 4000

In order to transfer files from your PC to the 4000, you must execute the TRANSFER program from both the 4000 and your PC.

1. Connect a VTC–9F cable with a null modem adapter between COM1 of your PC to COM1 of the 4000. Refer to Figure 2-4.

2. Execute the TRANSFER program from the 4000 to send a file to your PC.

   4000 C:\> **TRANSFER /COM1 /S /V *filename.ext***

   filename.ext is the name of the file on the 4000 which you are sending to your PC.

   /V enables “R” characters on receiving a block and “T” on transferring a block.

3. Execute the TRANSFER program from your PC to receive a file from the 4000.

   C:> **TRANSFER /COM1 /R /V *filename.ext***

   filename.ext is the name of the file on the PC which you are receiving from the 4000.

NOTE: Transfer will timeout if the program has not been started after approximately 40 seconds. It displays the following message:

```
Failed to receive <drive>filename.ext!
Deleting <drive>filename.ext
```

Also, you may speed up the transfer using the /Bnnnn switch to increase the baud rate. Example: /B57600.

The PC/104 connector allows you to interface to a variety of PC/104 form factor modules including video, analog I/O, floppy/hard disks, etc. These modules can be stacked on top of the 4000 to form a highly integrated control system (see Figure 12-1). Octagon's 2430 PC/104 SVGA card can be used to provide video for the 4000. A maximum of three PC/104 modules is recommended. Refer to Figure 2-1 for the location of the PC/104 mounting holes on the 4000 card.

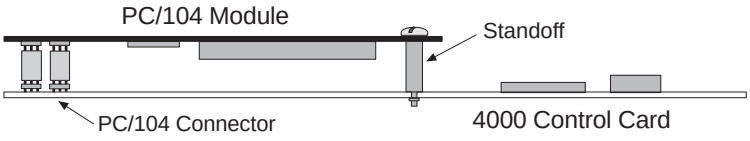

Figure 12–1—Typical PC/104 Module Stack

This page intentionally left blank.

CHAPTER 13 EXTERNAL DRIVES

DESCRIPTION

You can use your 4000 Control Card with one or two floppy disk drives and/or a hard disk drive. This chapter includes installation and operation instructions for each device. Also, refer to the instruction manuals included with each device.

For each of the devices below, the first step is to install the 4000 Control Card into the Micro PC backplane. Refer to the instructions in Chapters 4–5 if you will be booting from the BIOS drive or from SSD1 using ROM–DOS. If you are booting up using your own DOS, refer to the instructions in Chapter 14.

You can boot your 4000 from a floppy or hard disk. However, SSDDRIVE.SYS must be placed in your CONFIG.SYS file in order for the system to access the memory device in SSD1, SSD2 and the BIOS drive.

FLOPPY DISK DRIVES

You can add two floppy disk drives by using the 5800A Floppy/ Hard Disk Card with your 4000 card or add one 1.44 MB floppy drive with the 5815 Disk Drive Card (the 5815 also has a 2.5" IDE hard drive).

1. Install the 4000 Control Card.

2. Install the 5800A Floppy/Hard Disk Card or 5815 Disk Drive Card, following the instructions included with these products.

3. Plug the card cage power cable into an AC outlet. Turn on the power supply. This supplies power to the floppy disk drive (via the ribbon cable) as well as to the cards in the card cage.

4. Run SETUP to set the number of floppy drives and their size.

   NOTE: Two drive designators will be assigned regardless of how many drives you specify in SETUP.

5. When you boot from either the BIOS or SSD1 drives using ROM–DOS, the floppy drive designations will be A: and B:.

NOTE: When you boot from SSD1 using your own DOS, only one floppy drive will be available, since DOS thinks that SSD1 is drive A:. Connect your floppy disk drive to the second floppy connector on the 5800A (FDC drive B) and access it as B:. On the 5815 configure the drive with a jumper. See the *5815 Product Sheet*.

6. If, in SETUP, you entered 0 drives, access to either A: or B: will immediately generate an error message:

   ```
   ABORT RETRY FAIL?
   ```

   Press <A> or <F> to cancel your request.

   If, in SETUP, you entered 1 drive, you can access drive A. Requests to access drive B: result in the following prompt:

   ```
   INSERT FLOPPY INTO DRIVE B: AND PRESS ANY KEY
   ```

   Insert another floppy disk and press a key. The program then accesses your one drive as drive B:. When another request for drive A occurs, a prompt gives you the opportunity to replace the original A: floppy. In this way, systems with only one drive can copy files from one floppy to another.

   If, in SETUP, you entered 2 drives, access to either drive A: or drive B: work just as they would in a PC.

If you want to boot from the floppy disk using your own DOS or a full ROM-DOS refer to Chapter 14, *Using Your Own DOS*.

HARD DISK DRIVE

The 5800A and 5815 Micro PC Floppy/Hard Disk Drive Cards support IDE type hard drives. The disk drive designation for the first hard drive will be C:. If you boot from ROM–DOS in SSD1 or the BIOS drive, the ROM-DOS drive will be D:.

The SETUP (using HDSETUP) for the 5800A or 5815 should indicate 0 hard drives, while the 4000 SETUP program should contain the correct HD parameters. The HD BIOS on the 5815 can be disabled. See the *5815 Product Sheet* for more information.

The hard drive BIOS on the 4000 requires IRQ14 for the hard drive. The 5800A floppy/hard drive controller and the 5815 disk drive card are 8 bit cards, using IRQ5 on the bus. Therefore, jumper W3[11-12] (bus IRQ5 jumpered to 4000 card IRQ5) must be moved to W3[13-14] (bus IRQ5 jumpered to 4000 card IRQ14). Without this change, the 4000 hard drive BIOS will not recognize the hard drive. This applies to all 8 bit hard drive controllers. If using a PC/104 hard drive, IRQ14 is already used and the W3 jumper change is not needed.

W3: Interrupt Select		
Pins Jumpered	**Bus IRQ**	**CPU IRQ**
[11-12]*	IRQ5	IRQ5
[13-14]	IRQ5	IRQ14
[15-16]	IRQ4	IRQ4
[17-18]	IRQ4	IRQ11
[19-20]	IRQ3	IRQ3
[21-22]	IRQ3	IRQ10

* = default

This page intentionally left blank.

CHAPTER 14 USING YOUR OWN DOS

DESCRIPTION

Use these instructions instead of those in Chapter 2 if you are using your own DOS and not the ROM–DOS installed on the BIOS drive. You can boot from SSD1 or a floppy/hard disk when you use your own DOS. Initially, you will need to boot from the BIOS drive so that you can run SETUP and specify your system parameters, including where you want to boot from.

GETTING STARTED

1. Verify that power to the card cage is OFF and install your 4000 Control Card and peripheral equipment, except for the video card.

   WARNING: Plugging the card in backwards will destroy the card!

2. Install memory devices in SSD1 if it is not already in place. To install memory devices refer to Chapter 3, *EPROMs and Battery Backup*.

3. Connect one end of a VTC-9F cable to the null modem adapter and then to COM1 of your PC. Connect the other end to COM1 (J2) on the 4000. See Figure 2-4.

   NOTE: You must use COM1 on the 4000 in order to establish a serial communications link with your PC.

4. Start PC SmartLINK.

5. Power on the 4000.

6. A logon message similar to the one below will appear on your PC monitor:

```
Octagon 4000-386-25MHz-1MB BIOS Vers x.xx
Copyright (c) 1995 Octagon Systems, Corp. (TM)
All Rights Reserved
```

If you do not get the proper logon message:

- Remove W2[3–4]. If using COM1 as the console, check the serial parameters of your PC to make sure they are set correctly. The parameters should be 9600 baud, 8 data bits, no parity, and 1 stop bit.
- Make sure a video card is not installed.
- If the parameters are set correctly and the system still does not respond, refer to Chapter 17, *Troubleshooting*.

7. Use the directory command to make sure your equipment and software are working properly. Enter:

   ```
   4000 C:\> DIR
   ```

   A directory listing of ROM–DOS files stored in the BIOS socket should appear.

8. You are now ready to run SETUP to select boot, memory and drive options.

SELECTING BOOT, MEMORY, AND DRIVE OPTIONS

You must specify your system's parameters before you can save and run programs with the 4000 card. You define parameters by running the SETUP program. For a complete list of the options included in SETUP, please refer to Chapter 4, *SETUP*. As shipped, the BIOS drive is selected as the default boot device.

Booting the 4000 from a Floppy/Hard Disk Drive

1. Type:

   ```
   4000 C:\> SETUP
   ```

2. Select the answer to each question by pressing the space bar until the correct information appears, then press <ENTER>. Press <ESC> if you want to exit SETUP without saving your answers (or changes to the answers).

   When you reach the "Boot from" option, press the spacebar until "Floppy or Hard Disk" appears then press <RETURN> until SETUP is complete. Make sure the floppy number and size and/or hard drive parameters are correct.

3. After completing the information for SETUP, insert your bootable disk (which contains your DOS) into the floppy disk drive or add a bootable IDE hard drive.

4. Reboot the system by typing:

   ```
   4000 C:> RESET
   ```

Booting from SSD1 with/without a Floppy Drive

1. Create a bootable floppy disk on your PC and copy your DOS version of COMMAND.COM, all device drivers and necessary application files onto the floppy.

2. Copy the file DISKSEND.EXE from the 4000 utility disk to your PC. Make sure the file is in your DOS PATH or current directory. DISKSEND.EXE may already exist if you previously copied the 4000 utilities to your C:\MPC\4000 directory.

   The two programs, DISKSAVE and DISKSEND, transfer and save the files on the floppy disk to SSD1. The DISKSAVE program resides on the BIOS drive of the 4000 and the DISKSEND program resides on the 4000 utility disk.

3. Establish a serial communications link between your PC and the 4000.

   NOTE: If you are using COM2 on your PC, you must use the /C2 switch with DISKSEND. Refer to the DISKSEND section in Appendix A for more information. Also, if you cannot communicate at 38400 baud, use the /Bxxx switch on both DISKSAVE and DISKSEND.

4. On the 4000, execute the DISKSAVE program by typing:

   ```
   4000 C:\> DISKSAVE /DSSD1 /X
   ```

   The systems displays the following message:

   ```
   Attempting connection with DISKSEND on remote host.
   ```

5. If you are using PC SmartLINK IV, do the following steps. For other communication programs, skip to step 6.

   Press F9 (Shell to DOS) and enter the following:

   ```
   C:\MPC\4000> DISKSEND /FA
   ```

The system then erases and programs the flash memory. This takes several minutes.

When programming is complete, enter EXIT. This will return you to the SmartLINK screen. Press <ENTER> again and this will redisplay the 4000 C:\> prompt.

Go to step 7.

6. If using another communication program, exit to DOS and enter the following:

   C:> **DISKSEND /FA**

   The system then erases and programs the flash memory. This takes several minutes.

   When programming is complete, re-enter your communication program. Press <ENTER> and this will redisplay the 4000 C:\> prompt.

   Go to step 7.

7. Enter:

   4000 C:\> **RESET**

8. Display and verify the contents of SSD1:

   4000 C:\> **DIR E:**

9. Run SETUP and change your selection of the Boot options to: SSD1 using User supplied DOS/OS

10. Install jumper W2[3–4] and reboot your system by typing: 4000 C:\> **RESET**

CHAPTER 15 USER-DEFINED JUMPER

Jumper W2[5-6] is a user-defined jumper. This jumper can be read by code in your program for program direction.

W2: User Option	
Pins Jumpered	**Description**
[5-6]*	User-defined jumper

* = default

ENHANCED INT 17H FUNCTION DEFINITIONS

This section provides the definition for the Read Jumpers function.

Read Jumpers

Function: fbh
Subfunction: 03h

Purpose: To read the on-board jumper settings.

Calling Registers: AH fbh
AL 03h
DX ffffh

Return Registers: AL Jumper setting (1=ON; 0=OFF)
Bit 2 = W2 5-6
Bit 1 = W2 3-4
Bit 0 = W2 1-2

Comments: This function returns the W2 jumper settings. The settings only reflect the ON/OFF states of the jumper during reset. If you change the jumpers after the system has come up, this function will not reflect those changes.

Programming Example:

```
/* The following example program reads the user
defined jumper */
unsigned char jumper;
/* Inline assembly code for Borland C++ 3.1 */
asm {
            mov     ax,0fb03h
            mov     dx,0ffffh
            int     17h
            mov     jumper,al
     }
    if(jumper & 4)        /* look at bit 2 */
        printf("W2 5-6 is ON\n");
    else
        printf("W2 5-6 is OFF\n");
```

CHAPTER 16 CPU POWER MANAGEMENT

DESCRIPTION

The power demands of a system can severely limit an application due to thermal constraints or the raw power usage in a battery-operated application. In order to maintain speed and efficiency, a software-controlled, power management system must be tailored to the application. Even if your application is operating within specified limits, a power management system may improve the life and reliability of your system by reducing thermal stress to the CPU.

Octagon provides two power management software utilities, **SLEEP.COM** and **SLOW.COM**, with all CPU cards. Octagon has also developed an Advanced Power Management Terminate and Stay Resident (TSR) program with source code examples that can be modified for use within your application software. These files are available on the Octagon BBS (Tel. No.: 303-427-5368). The file is called *powermgt.zip* and is located in the Downloads area (3).

SLEEP.COM

The **SLEEP.COM** power management utility executes a halt (sleep mode) in the microprocessor. Also, in some of the later AT MicroPC's, the charge pumps, that generate the +12V and -12V required for COM port transmission, are disabled. Execution of the **SLEEP.COM** utility reduces the MicroPC power consumption by approximately 65% to 73% in AT PC's and 30% to 34% in XT PC's (results will vary depending on the MicroPC model and memory configuration). Any hardware interrupt, except IRQ0 (the 54.9 mS Tick Timer is disabled during **SLEEP.COM**) wakes the microprocessor, returning it to its normal function and speed. Any external hardware used to generate the interrupts will add to the total power usage. A keyboard, for example, adds approximately 100 mA to your sleep mode current.

> **NOTE:** Some software applications will not work correctly when IRQ0 is disabled. See the *Advanced Power Management TSR* section below for an alternative to **SLEEP.COM**.

In AT CPU's, the CMOS Real Time Clock can be programmed to generate an interrupt (IRQ8) that will wake itself up after a preprogrammed period of time. The file *sleepat.asm* is included in the *powermgt.zip* download file. This file contains the code for building your own **SLEEP.COM**. The code includes everything **SLEEP.COM** performs (for AT CPU's only), and an example for programming the CMOS Real Time Clock to generate an IRQ8, as a self wake-up feature.

SLOW.COM

The **SLOW.COM** power management utility reduces the microprocessor clock speed by 50% in AT CPU's and 60% in XT CPU's. The execution of this utility also reduces the MicroPC power consumption by approximately 20% to 27%. Again results will vary depending on the MicroPC model and memory configuration. The microprocessor is returned to normal speed by executing **FAST.COM**.

IMPLEMENTATION

Software implementation of these utilities can be performed by two methods: in the application executable file, or in a batch file.

You can execute any power management utility from within your executable file by using the **SHELL** command in Microsoft QuickBASIC, or the **SYSTEM** command in Borland C++. The power management utilities can also be setup in a batch file for implementation after an application file has completed execution (see the example below).

```
"AUTOEXEC.BAT" :DOAGAIN        ! Start of Application loop
                 MYPROG1.EXE   ! First Application segment
                 SLEEP.COM     ! Waiting for interrupt to continue
                 MYPROG2.EXE   ! Second Application segment
                 SLOW.COM      ! Reduce processor speed for next segment
                 MYPROG3.EXE   ! Third Application segment
                 FAST.COM      ! Full processor speed for next segment
               GOTO DOAGAIN    ! Restart total application loop
```

ADVANCED POWER MANAGEMENT TSR

The Advanced Power Management TSR program, after successful installation, provides power management control via interrupt 15 calls from within the application software. This utility is similar to **SLEEP.COM**, except that all hardware interrupts including IRQ0 (Tick Timer) will wake the microprocessor, and return it to its normal function and speed. However, if IRQ0 is the interrupt detected, the microprocessor will only update the clock and return to sleep mode until the next interrupt (another 54.9 mS for IRQ0). The source code that is supplied with the TSR has examples in Assembly, C, and QuickBASIC. The source code demonstrates examples for: checking TSR status, TSR connection, CPU halt (sleep mode), TSR disconnect, and charge pump control for the COM port transmitters.

CHAPTER 17 TROUBLESHOOTING

If your system is not working properly, check the following items:

No Screen Activity – Checking Serial Communications for Console

If you do not get the sign–on message after bootup:

1. Make sure all cards except the 4000 card are removed from the card cage. This ensures that other cards are not interacting with the 4000 and that a video card is not installed.

2. Install W2[1–2] or remove W2[3–4].

3. The VTC–9F serial cable turns the 4000 Control Card serial port into a 9–pin AT serial port. Make sure a null modem adaptor is installed on the other end, and that the assembly is inserted into the proper serial port on the PC. Make sure the VTC–9F serial cable is connected to J1 on the Control Card. See Figure 2-4.

4. Make sure your power module provides +5V (+/–0.25V).

5. After verifying the above conditions, you can monitor voltage levels by connecting an oscilloscope between the TxD* line on J1 (pin 5) and ground. After power–up, you should see a burst of activity on the oscilloscope screen. The voltage level should switch between +/–8V.

Garbled Screen Activity

If you do get activity on your screen but the message is garbled, check the following:

1. Remove W2[3–4] to force 9600, N, 8, 1 for COM1.

2. If you are using PC SmartLINK, make sure you have configured the software for 9600 baud and have selected the correct serial port for communicating with your PC. Refer to the PC SmartLINK manual for information on selecting the baud rate.

3. If you are using communications software other than PC SmartLINK, Octagon cannot guarantee the operation. Make sure that the software parameters are set to match those of the 4000 Control Card: 9600 baud, 8 bits, 1 stop bit, no parity.

System generates a BIOS message but locks up when booting from SSD1:

1. Remove W2[3–4] to force booting from the BIOS drive.

2. Press the reset button and reboot. Then note the drive designator for SSD1.

3. Display the directory of SSD1 and verify that all the necessary boot files exist. Copy any missing files to the floppy disk and re-execute DISKSEND and DISKSAVE.

4. If no files are missing, remake SSD1 to overwrite any files which may have become corrupted.

System boots from BIOS drive even though I specified boot from SSD1 using ROM–DOS:

1. Make sure SSD1 is programmed.

Booting from SSD1 with user-supplied DOS doesn't work:

1. If you made SSD1 using a floppy drive, test that you can boot using that disk on the floppy drive of your PC. Also, make sure all the necessary boot files are present. If the floppy is bootable and all files are present, re-execute DISKSAVE and DISKSEND.

Cannot save programs to flash memory

1. Make sure the EPROM is installed in SSD1 correctly and that there are no bent pins. Also, make sure that jumper W3 is set up correctly.

SSDDRIVE.SYS reports device not present with new flash memory installed.

1. If you use a 5V flash memory that does not operate in a read/write mode, you must program the EPROM using DISKSEND and DISKSAVE. Refer to the *SSDDRIVE.SYS* section in Appendix A, and Chapter 5, *Save and Run Programs*.

System will not recognize hard drive.

The hard drive BIOS on the 4000 requires IRQ14 for the hard drive. The 5800A floppy/hard drive controller and the 5815 disk drive card are 8 bit cards, using IRQ5 on the bus. Therefore, jumper W3[11-12] (bus IRQ5 jumpered to 4000 card IRQ5) must be moved to W3[13-14] (bus IRQ5 jumpered to 4000 IRQ14). Without this change, the 4000 hard drive BIOS will not recognize the hard drive. This applies to all 8-bit hard drive controllers. If using a PC/104 hard drive, IRQ14 is already used and the W3 jumper change is not needed.

Parity errors.

A Parity Error 1 message indicates a system memory (DRAM) problem.

A Parity Error 2 message indicates a NMI interrupt was generated. The NMI interrupt source can be from the A1 position (-IOCHK) on the 8-bit ISA bus or the PC/104 connector or from the power fail circuit. Jumper W2[7-8] selects the bus NMI, W2[9-10] selects power fail NMI. If selecting the power fail position, an NMI interrupt is generated if power drops below 4.75V.

The Parity Error 2 message is a generic, default message for the NMI interrupt handler. You must install your own interrupt handler, such as a routing to respond to power fail, in response to the NMI interrupt.

System locks up on power up; may or may not respond to reset switch.

A common cause is using a non-Octagon power supply such as a PC desktop supply. Most of these PC supplies are rated at 5V at 20A or more. Switching supplies usually requires a 20% load to operate properly, that is, 4A or more. Since a typical Micro PC system takes less than 2A, the supply does not regulate properly. Ouput drift up to 6-7V and/or 7-8 voltage spikes have been reported. If the power supply comes up slowly (that is, longer than 50 ms), the sequencing of ICs on the board may be out of sync, thus, causing the system to lock up.

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on power down and to regulate properly under a no load condition.

System locks up after power down/power up.

If the power supply does not drain below 0.7V, the CMOS components on the card will act like diodes and forward bias. This is typically caused by using power supplies that have large output capacitors. Either use a different power supply that discharges faster, leave the power off until the supply has adequate time to discharge or place a 100 ohm, large wattage resistor across the output capacitor.

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on power down and to regulate properly under a no load condition.

TECHNICAL ASSISTANCE

Carefully recheck your system before calling Technical Support. Run as many tests as possible; the more information you can provide, the easier it will be for the Technical Support staff to help you solve the problem.

For technical assistance, please call 303–426–4521.

TECHNICAL SPECIFICATIONS

CPU
80386SX

Clock
12.5 or 25 MHz, 25 MHz is default; software selectable.

BIOS
AT compatible with industrial extensions with the following exceptions:

- Uses 8–bit bus
- DMA 16–bit channels not available except via PC/104

Interrupts
IRQ3 & IRQ4 on bus are jumperable between IRQ3 & IRQ4 or IRQ10 & IRQ11 on–card. IRQ5 on bus is jumperable between IRQ5 or IRQ14 on card.

DRAM
512K, 1 MB, 2 MB, or 4 MB options. DRAM is soldered onto the card.

Solid–State Disk 1
Supports 128K or 512K, 5V only flash memory for application program. Order Octagon P/N 4321: 512K 5V read/write flash memory.
Supports 512K (27C040) or 1 MB (27C080) EPROMs.

Solid–State Disk 2
Supports 128K or 512K SRAM soldered on card.

ROM–DOS
Combined with BIOS ROM; DOS 6.22 compatible.

Serial I/O
COM1 and COM2 are 16C450 compatible.

Parallel Port
LPT1 is PC compatible with bidirectional capability.

Battery backup
AT style battery. Order Octagon P/N 3186.

Power Requirements
386SX Processor:
5V at 600 mA typical (512K); 5V at 610 mA typical (1 MB)
5V at 610 mA typical (2 MB); 5V at 620 mA typical (4 MB)

Environmental Specifications
–40° to 70° C operating
–55° to 90° C nonoperating
RH 5% to 95%, noncondensing

Size
4.5 in. x 4.9 in.

Watchdog Timer
Default timeout is 1.6 seconds (typical), software enabled and strobed. Disabled on power–up and reset. Address of the enable timer is 380H; address of strobe is 388H.

Bus Mastering
Bus mastering is not supported.

Mating Connectors
J1, J2 Serial Port, 10-pin Mating Connector:
Connector: Thomas & Betts #609-1030
Strain Relief: Thomas & Betts #609-1031

J5 Parallel Printer Port, 26-pin Mating Connector:
Connector: Thomas & Betts #609-2630
Strain Relief: Thomas & Betts #609-2631

J9 Speaker, 3-pin Mating Connector:
Connector Housing: DuPont BERG #65039-033
Crimp Terminals: DuPont BERG #48235-000

J10 Opto-isolated Reset and Interrupt, 4-pin Mating Connector:
Connector Housing: DuPont BERG #65039-033
Crimp Terminals: DuPont BERG #48235-000

Memory Map

4000 Memory Map	
Address	**Description**
00000-9FFFFH	System Memory
A0000-DFFFFH	Off-card
E0000-E7FFFH	Off-card
E8000-EFFFFH	SSD Memory Window
F0000-F7FFFH	BIOS Extensions
F8000-FFFFFH	System BIOS

I/O Map

4000 I/O Map	
Hex Range	**Function**
0000-00FFH	Core logic I/O functions
0100-0207H	Off card
0208-020FH	Bit port
0208H	Serial EEPROM CS
0209H	Serial EEPROM Data input
020AH	Serial EEPROM Clock
020BH	Serial EEPROM program enable
020CH	Super peripheral I/O powerdown
020DH	Not used
020EH	RS-232 powerdown
020FH	SSD bank switch A19
0210-02F7H	Off card
02F8-02FFH	COM2 serial port
0300-0377H	Off card
0378-037FH	LPT1 printer port
0380-0387H	Bit port
0380H	Watchdog enable
0381H	SSD bank switch A15
0382H	SSD bank switch A16
0383H	SSD bank switch A17
0384H	SSD bank switch A18
0385H	SSD socket select lower bit
0386H	Power LED switch
0387H	SSD socket select higher bit
0388-038FH	Watchdog strobe
0390-03F7H	Off card
03F8-03FFH	COM1 serial port

JUMPER SETTINGS

W1: COM2 Source Select	
Pins Jumpered	**Description**
[1-2]*	Nominal COM2 RS-232
[1-3]	GPS installed. No DGPS input.
[1-3, 2-4]	GPS installed. DGPS input active.

* = default

W2: NMI Interrupt Source	
Pins Jumpered	**Description**
[7-8]*	Bus NMI
[9-10]	Power Fail NMI

* = default

W2: COM1, Video and BIOS Boot Options		
Pins Jumpered	**Video System**	**Description**
[1-2][3-4]*	No video card installed in system.	Video over COM1. System will boot SETUP boot device
[1-2]		Video over COM1. System will boot BIOS drive.
[3-4]		No COM1 video available. COM1 available for use in application. System will boot SETUP boot device.‡
[3-4]†	Video card installed in system.	Video on CRT. System will boot SETUP boot device.
[3-4] not jumpered†		Video on CRT. System will boot BIOS drive.

* = default

† = W2[1-2] is ignored

‡ = If SETUP boot device is BIOS drive, system will use video over COM1.

W2: User Option	
Pins Jumpered	**Description**
[5-6]*	User-defined jumper

* = default

W3: SSD1 Memory Device Select	
Pins Jumpered	**Description**
[1-3][2-4]*	Flash memory
[3-5][4-6]	EPROM

* = default

W3: SSD2 Battery Jumper	
Pins Jumpered	**Description**
[7-8]*	Battery backup for calendar/clock & GPS. No battery backup for SSD2.
[9-10]	Battery backup for calendar/clock, GPS & SSD2.

* = default

W3: Interrupt Select		
Pins Jumpered	**Bus IRQ**	**CPU IRQ**
[11-12]*	IRQ5	IRQ5
[13-14]	IRQ5	IRQ14
[15-16]	IRQ4	IRQ4
[17-18]	IRQ4	IRQ11
[19-20]	IRQ3	IRQ3
[21-22]	IRQ3	IRQ10

* = default

W4: IRQ15 Opto Interrupt Enable	
Pins Jumpered	**Description**
[1-2]	IRQ15 connected to opto interrupt input
None*	IRQ15 disconnected from opto interrupt input

* = default

CONNECTOR PINOUTS

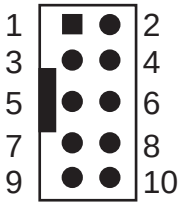

Figure 18–1—Typical 10–pin IDC Connector

J1: COM1 and J2: COM2 Serial Ports		
Pin #	**COM1**	**COM2**
1	N.C.	N.C.
2	DSR	N.C.
3	RxD*	RxD*
4	RTS	RTS
5	TxD*	TxD*
6	CTS	CTS
7	N.C.	N.C.
8	N.C.	N.C.
9	Gnd	Gnd
10	+5V	+5V

* = active low

J3: Keyboard/ Port	
Pin #	**Function**
1	Keyboard data
2	NC
3	Gnd
4	+5V
5	Keyboard clock
6	NC

J4: Battery Connector	
Pin #	**Function**
1	+Battery
2	Key
3	Gnd
4	Gnd

J5: LPT1 Printer Port		
Pin #	**Function**	
1	Out	STB*
2	O1ut	AFD*
3	I/O	D0
4	In	ERR*
5	I/O	D1
6	Out	INIT*
7	I/O	D2
8	Out	SLIN*
9	I/O	D3
10	Gnd	Gnd
11	I/O	D4
12	Gnd	Gnd
13	I/O	D5
14	Gnd	Gnd
15	I/O	D6
16	Gnd	Gnd
17	I/O	D7
18	Gnd	Gnd
19	In	ACK*
20	Gnd	Gnd
21	In	BUSY
22	Gnd	Gnd
23	In	PE
24	Gnd	Gnd
25	In	SLCT
26	+5	+5

* = active low

J7: PC/104 Bus Signal Assignments				
Pin #	**Row A**	**Row B**	**Row C**	**Row D**
0	--	--	Gnd	Gnd
1	IOCHCK*	Gnd	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	N.C.	LA20	IRQ12
6	SD3	DRQ2	LA19	IRQ15
7	SD2	N.C.	LA18	IRQ14
8	SD1	0WS*	LA17	DACK0*
9	SD0	+12V	MEMR*	DRQ0
10	IOCHRDY	(KEY)	MEMW*	DACK5*
11	AEN	SMEMW*	SD8	DRQ5
12	SA19	SMEMR*	SD9	DACK6*
13	SA18	IOW*	SD10	DRQ6
14	SA17	IOR*	SD11	DACK7*
15	SA16	DACK3*	SD12	DRQ7
16	SA15	DRQ3	SD13	+5V
17	SA14	DACK1*	SD14	N.C.
18	SA13	DRQ1	SD15	Gnd
19	SA12	REFRESH*	(KEY)	Gnd
20	SA11	SYSCLK	--	
21	SA10	IRQ7	--	
22	SA9	IRQ6	--	
23	SA8	IRQ5	--	
24	SA7	IRQ4	--	
25	SA6	IRQ3	--	
26	SA5	DACK2*	--	
27	SA4	TC	--	
28	SA3	BALE	--	
29	SA2	+5V	--	
30	SA1	OSC	--	
31	SA0	Gnd	--	
32	Gnd	Gnd	--	

* = active low

J9: Speaker Connector	
Pin #	**Function**
1	Gnd
2	Speaker data
3	+5V

J10: Opto-Isolated Reset & Interrupt	
Pin #	**Signal**
1	+ IRQ
2	- IRQ
3	- Reset
4	+ Reset

J14: GPS Port		
Pin #	**CM2 Function**	**CM3 Function**
1	VCC Antenna (+5V)	VCC Antenna (+5V)
2	VCC (+5V)	VCC (+5V)
3	TxD (TTL)	TxD (TTL)
4	Battery Backup	Battery Backup
5	RxD (TTL)	RxD (TTL)
6 (N.C.)	One pulse per second (TTL)	One pulse per second (TTL)
7	N.C.	RxD_DGPS (TTL)
8	Gnd	Gnd

MICRO PC BUS PINOUTS

Micro PC "A"					
Pin #	**Description**	**Signal**	**Pin #**	**Description**	**Signal**
A1	I/O CH CK*	I	A17	A14	O
A2	D7	I/O	A18	A13	O
A3	D6	I/O	A19	A12	O
A4	D5	I/O	A20	A11	O
A5	D4	I/O	A21	A10	O
A6	D3	I/O	A22	A9	O
A7	D2	I/O	A23	A8	O
A8	D1	I/O	A24	A7	O
A9	D0	I/O	A25	A6	O
A10	I/O CH RDY	I	A26	A5	O
A11	AEN	O	A27	A4	O
A12	A19	O	A28	A3	O
A13	A18	O	A29	A2	O
A14	A17	O	A30	A1	O
A15	A16	O	A31	A0	O
A16	A15	O			

* = active low

Micro PC "B"					
Pin #	**Description**	**Signal**	**Pin #**	**Description**	**Signal**
B1	GND	I	B17	DACK1*	O
B2	RESET	O	B18	DRQ1	I
B3	+5V	I	B19	DACK0*	O
B4	IRQ9	I	B20	CLOCK	O
B5	N.C.	Not used	B21	IRQ7	I
B6	DRQ2	I	B22	IRQ6	I
B7	-12V	Not used	B23	IRQ5	I
B8	Reserved	Not used	B24	IRQ4	I
B9	+12V	Not used	B25	IRQ3	I
B10	Analog Gnd	Not used	B26	DACK2*	I
B11	MEMW*	O	B27	T/C	I
B12	MEMR*	O	B28	ALE	O
B13	IOW*	O	B29	Aux +5V	Not used
B14	IOR*	O	B30	OSC	O
B15	DACK3*	O	B31	GND	I
B16	DRQ3	I			

* = active low

This page intentionally left blank.

APPENDIX A SOFTWARE UTILITIES

INTRODUCTION

The 4000 ROM–DOS and Software Utility Disk comes with the utilities listed below. Some of these utilities are also available on the 4000 BIOS drive. This appendix describes the utilities and their use.

Support commands:

COM1CON.COM
DISKSAVE.EXE
DISKSEND.EXE
FAST.COM
FMTSSD.EXE
LPT1CON.COM
RESET.COM
SETUP.COM
SLEEP.COM
SLOW.COM
TRANSFER.EXE

Support device drivers:

SSDDRIVE.SYS
VDISK.SYS

NOTE: Other utilities are included from ROM–DOS and are not mentioned in this section. Please refer to your ROM–DOS manual.

COM1CON.COM

COM1CON.COM Support Command

PURPOSE: Redirects video to the COM1 port when you have a video card and monitor installed in your system and restores COM1 serial parameters.

SYNTAX: **COM1CON**

REMARKS: Execute COM1CON from the command line. When you are finished using the console port, reset your system. After boot-up, the system reverts to using the video card and monitor.

Also, some programming languages may not restore the serial parameters after using the COM1 port. COM1CON.COM will restore the COM1 port as the console. You must include your program and COM1CON in a batch file and then execute the batch file to restore the console.

SEE ALSO: LPT1CON.COM

DISKSAVE.EXE

DISKSAVE.EXE: Support Command

PURPOSE: To program a disk into SSD1 (5V-FLASH MEMORY) or to create disk image files for SSD1 (EPROM).

SYNTAX: **DISKSAVE** [/**D***y*] [/**S***s*] [/**I**]
[/**F***d* | *path* | *filespec* | /**X** [/**C***c*] [/**B***b*]]

PARAMETERS: **/D***y* specifies the destination device to be programmed. Currently, *y* can be SSD1. The default is SSD1.

/S*s* specifies the output is an image file and specifies the size of the EPROM to be programmed. *s* can be either 512K or 1M. The default is 512K.

/I specifies the source for programming to be an image file.

/F*d* specifies the source for programming to be a local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter.

path specifies the source for programming to be a local tree of files.

filespec specifies the full path name of the image file to be used with the **/I** option.

/X specifies the source for programming is done through communication over a serial link connecting the 4000 to a remote host system running DISKSEND.EXE.

/C*c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/B*b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To program SSD1 from local drive A, enter:

```
DISKSAVE  /FA  /DSSD1
```

EXAMPLE 2: To program SSD1 from local subdirectory C:\DEMO\TEST, enter:

```
DISKSAVE  C:\DEMO\TEST  /DSSD1
```

EXAMPLE 3: To program SSD1 from remote drive A, first enter the following command on the 4000:

```
DISKSAVE  /X  /DSSD1
```

Then enter the following command on the remote host system:

```
DISKSEND  /FA
```

EXAMPLE 4: To program SSD1 from a remote subdirectory C:\DEMO through COM2 at baud rate 9600, first enter the following command on the 4000:

```
DISKSAVE  /X  /DSSD1  /C2  /B9600
```

Then enter the following command on the remote host system:

```
DISKSEND  C:\DEMO  /B9600
```

EXAMPLE 5: To create a 1 MB image file for the SSD1 EPROM from local drive A, enter:

```
DISKSAVE  /FA  /DSSD1  /S1M
```

EXAMPLE 6: To create a 512K image file for SSD1 from a local subdirectory named C:\TEST, enter:

```
DISKSAVE  C:\TEST  /DSSD1  /S512K
```

EXAMPLE 7: To program SSD1 from an image file C: \TEST\SSD1.IMG, enter:

```
DISKSAVE /I /DSSD1   C:\TEST\SSD1.IMG
```

REMARKS: When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a bootable drive (use the /**F***d* option) from either a remote or local system.

When a subdirectory path is used as input to DISKSAVE.EXE, DISKSAVE creates a temporary file in the current directory. Consequently, the current directory cannot be included in the specified path and must not be write-protected.

The filename of the image file created for the SSD1 EPROM is SSD1.IMG.

The size of the disk image file generated with DISKSAVE.EXE is made only as large as required to minimize programming time.

SEE ALSO: DISKSEND.EXE, TRANSFER.EXE

DISKSEND.EXE

DISKSEND.EXE: Support Command

PURPOSE: To send a disk image through a serial link to the DISKSAVE.EXE program running on the 4000.

SYNTAX: **DISKSEND** [/**F***d* | *path*] [/**C***c*] [/**B***b*]

PARAMETERS: /**F***d* specifies the source for programming to be the local drive. The disk image of the specified drive is used. *d* can be any DOS drive letter. Use /**F***d* when not using path.

path specifies the source for programming to be a local tree of files. Use *path* when not using /**F***d*.

/**C***c* specifies the COM port *c* to be used. Use /**C** only when /**X** is used. *c* can be 1, 2, 3 or 4. The default is 1.

/**B***b* specifies the baud rate *b* to be used. Use /**B** only when /**X** is used. *b* can be 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The default is 38400.

EXAMPLE 1: To send a local disk image (that is to be programmed into SSD1) through the serial link to the 4000 running DISKSAVE.EXE, first enter the following command on the 4000:

```
DISKSAVE  /X  /DSSD1
```

Then enter the following command at the host system:

```
DISKSEND  /FA
```

EXAMPLE 2: To send the image of floppy drive A via COM2 at the host system, that is to be programmed into SSD1 via COM1 at the 4000, first enter the following command on the 4000:

```
DISKSAVE  /X  /DSSD1  /C1
```

Then enter the following command at the host system:

```
DISKSEND  /C2  /FA
```

REMARKS: When DISKSAVE.EXE is used in conjunction with DISKSEND.EXE, the /**X** option must be used.

When the /**F***d* option is used, the drive specified must have a sector size of 512 bytes. Both 1.44M and 720K floppies have a sector size of 512 bytes.

To program an SSD which boots from a user-supplied DOS or full ROM–DOS, the source must be a floppy drive (use the /**F***d* option).

The size of the disk image generated with DISKSEND.EXE that was sent over the serial link is made only as large as required to minimize transfer and programming time.

SEE ALSO: DISKSAVE.EXE, TRANSFER.EXE

FAST.COM

FAST.COM Support Command

PURPOSE: To change CPU clock speed from 12.5 MHz to 25 MHz for the 4000.

SYNTAX: **FAST**

REMARKS: Enter the following command to change to the 25 MHz clock speed during system bootup for the 4000:

FAST

You can also enter <CTL><ALT><+> to switch to 25 MHz if you are using a keyboard and monitor with the 4000.

The default speed is **fast** after a reset.

FMTSSD.EXE

FMTSST.EXE Support Command

PURPOSE: To format a solid state disk (5V flash or static RAM).

SYNTAX: **FMTSSD** [**SSD1** | **SSD2**] [*sizeK*]

PARAMETERS: **SSD1** specifies the SSD1 device.

SSD2 specifies the SSD2 device.

sizeK specifies the desired size (in kilobytes) of the SSD to be formatted. The default size is the maximum possible. *sizeK* specified must be smaller than the device size, but larger than 64.

REMARKS: The 5V flash supported by this command are:

Atmel: 29C010, 29C040, 29C040A
SST: 28FS040, 29EE010

NOTE: You cannot format an AMD 29F040 5V flash with this command. You must use DISKSEND or DISKSAVE to program it.

LPT1CON.COM

LPT1CON.COM Support Command

PURPOSE: Redirects the video to the LPT1 port.

SYNTAX: **LPT1CON**

REMARKS: If you have an LCD-IFB or DP-IFB interface board and a display connected to LPT1, executing the DISPLAY.EXE and LPT1CON.COM programs allow you to use the display as the system console. You must reset your system to change the video to the original parameters.

SEE ALSO: COM1CON.COM, DISPLAY.DOC on the utility disk

RESET.COM

RESET.COM Support Command

PURPOSE: To enable the watchdog timer and allow timeout to expire, thus restarting the system.

SYNTAX: **RESET**

REMARKS: The RESET command also restarts all the expansion I/O cards on the bus. This differs from a <CTL><ALT><DEL> reboot of the system which only restarts the system but not the expansion cards. The RESET button on the 4000 also accomplishes the same thing as the RESET command.

SETUP.COM

SETUP.COM Support Command

PURPOSE: Modifies date and/or time for battery–backed clock, and modifies serial port parameters.

SYNTAX: **SETUP** [**/D**]

PARAMETER: **/D** returns all setup values to default values.

REMARKS: From the directory where this utility file is located, enter:

SETUP

After the copyright message displays, the main menu appears:

```
OCTAGON SYSTEMS CORPORATION
4000 SETUP UTILITY V3.2
---------------------------
(Press SPACE to CHANGE, ENTER to
ACCEPT, ESC to EXIT)

COM1 Console baud rate:      1200
                             2400
                             4800
                             9600
                             19200
                             38400
                             57600

Power on memory test:Enabled
                     Disabled

SSD1 Device          none
                     128K 5V FLASH
                     512K 5V FLASH
                     EPROM (27C0X0)

Boot from:   BIOS drive using ROM–
             DOS
             SSD1 using ROM–DOS
             Floppy or Hard drive
             SSD1 using user sup-
             plied DOS
```

```
Number of floppy drives:0
                        1
                        2

Floppy drive 1 size:    360K
                        1.2 MB
                        720K
                        1.44 MB

Shadow 0C000H–0C7FFH:   Yes
                        No

Shadow 0C700H–0CFFFH:   Yes
                        No

Number of line printers:Auto Check
                        0
                        1
                        2
                        3

Number of hard drives:  0
                        1
                        2

Drive 0 parameters:
            Cylinders (xxx):
            Heads (x):
            Sectors (xx):

Press ENTER to SAVE the changes or
Press ESC to EXIT without saving
the changes:

Options saved.
You must reset for these options
to take effect.
```

SLEEP.COM

SLEEP.COM Support Command

PURPOSE: To conserve CPU power consumption.

SYNTAX: **SLEEP**

REMARKS: The command puts the processor in “sleep” mode, thus using less power. An interrupt awakens the processor and lets it resume its activities. The DOS clock is stopped while in sleep mode. The 18.2 per second timer tick is disabled during this time. All other interrupts (i.e., serial and keyboard) are left enabled. When the processor is awakened via an interrupt (usually via COM1 or keyboard), the timer tick is reenabled and the DOS time is updated from the CMOS clock.

SLOW.COM

SLOW.COM Support Command

PURPOSE: To change CPU clock speed from 25 MHz to 12.5 MHz for the 4000.

SYNTAX: **SLOW**

REMARKS: Enter the following command from the DOS prompt or in a batch file to change to the 12.5 MHz clock speed for the 4000:

```
SLOW
```

You can also press <CTL><ALT><–> to change to 12.5 MHz if you are using a keyboard and monitor with the 4000.

SEE ALSO: FAST.COM

SSDDRIVE.SYS

SSDDRIVE.SYS Device Driver

PURPOSE: This device driver is used when the user wishes to access the on–card SSDs.

SYNTAX: **DEVICE=SSDDRIVE.SYS** [**BIOS** | **SSD1** | **SSD2**] [*sizeK*] [**/FORMAT** | **/NOFORMAT**]

PARAMETERS: **BIOS** specifies the BIOS drive.

SSD1 specifies the SSD1 device.

SSD2 specifies the SSD2 device.

sizeK specifies the desired size (in kilobytes) of the SSD to be formatted. The default size is the maximum size possible. The specified *sizeK* must be smaller than the device size, but larger than 64.

/FORMAT instructs the driver to format the installed SSD device if it does not look like a DOS drive. This is the default setting.

/NOFORMAT instructs the driver NOT to format the installed SSD device even if it does not look like a DOS drive. The switch has no effect if the installed device looks like a DOS drive. The switch is useful if SSD is not used as a DOS drive. If formatting is desired later, use FMTSSD.EXE to format the SSD.

REMARKS: The following CONFIG.SYS entries allow the user to access on–card SSDs:

`DEVICE=SSDDRIVE.SYS BIOS`	Accesses BIOS Drive
`DEVICE=SSDDRIVE.SYS SSD1`	Accesses SSD1

This driver first checks the SSD to see if it looks like a valid disk. If it does, the system assigns a drive letter, after which time you can access the device as a normal disk. The drive letter for the virtual drive is dependent on the order of the devices listed in the CONFIG.SYS file. If the SSDDRIVE.SYS driver does not detect a valid programmed SSD, one of the following messages will be displayed:

EPROM installed:

```
SSDDRIVE.SYS V1.00 SSD not found
```

AMD 29F040 5V flash installed:

```
SSDDRIVE.SYS V1.00 SSD not found
```

Atmel 29C010, 29C040, or 29C040A; SST 28FS040 or 29EE010 installed:

If the **/NOFORMAT** switch is used,

```
SSDDRIVE.SYS V1.00 SSD not found
```

If the **/FORMAT** switch is used (default), the SSD is formatted to *sizeK*. If *sizeK* is not specified, the SSD is formatted to its maximum size capacity.

SSDDRIVE.SYS supports the following flash devices:

AMD29040 (512K)	**read only** through SSDDRIVE.SYS; write through DISKSAVE.EXE.
SST PH29EE010 (128K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
SST PH28SF040 (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C010 (128K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C040 (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.
Atmel 29C040A (512K)	read/write through SSDDRIVE.SYS; write through DISKSAVE.EXE.

Order Octagon P/N 4321: 512K 5V read/write flash memory.

EXAMPLE 1: `DEVICE=SSDDRIVE.SYS SSD1 /NOFORMAT`

This command entry specifies that SSD1 is not to be formatted even if it may not look like a valid drive.

EXAMPLE 2: `DEVICE=SSDDRIVE.SYS SSD2 100`

This command entry specifies that if SSD2 looks like a drive, it is not to be altered. If SSD2 does not look like a drive, it is to be formatted to 100K regardless of the SSD2 device size.

TRANSFER.EXE

TRANSFER.EXE Support Command

PURPOSE: To transfer files to or from the 4000 over a serial port.

SYNTAX: **TRANSFER** *filepath* [/**S** | /**R**] [/**B***b*] [/**V**] [/**COM***c*]

PARAMETERS: *filepath* specifies the file pathname to send or receive.

SWITCHES: /**S** specifies to send the file.

/**R** specifies to receive the file. This is the default.

/**B***b* specifies baud rate of transfer where *b* can be (300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115 (115200)). The default is 9600 when using a /**COM***c* switch. If COM1 is the console, the baud rate defaults to the current console baud rate.

/**V** enables the display of "R" when a block (128 bytes) is received, or "T" when a block is transmitted.

NOTE: Do not use /**V** when COM1 is the console device.

/**COM***c* specifies the serial port to use. *c* can be 1-4. The default is 1.

EXAMPLE 1: To send a file named C:\MPC\DEMO\DEMO.EXE on the 4000 when using COM1 as the console, enter the following command:

```
TRANSFER D:DEMO.EXE
```

On the remote PC executing SmartLINK, press <ALT> <D>, type C:\MPC\DEMO\DEMO.EXE, and then press ENTER.

EXAMPLE 2: To send a file named D:DEMO.BAS to the file C:\TEST.BAS on the remote PC when using COM1 as the console, enter the following on the 4000:

```
TRANSFER /S D:DEMO.BAS
```

On the remote PC executing SmartLINK, press <ALT> <U>, type C:\TEST.BAS, and then press <ENTER>.

EXAMPLE 3: To send a file named C:\DEMO\DEMO.EXE from a remote PC to the file named D:\DEMO.EXE on the 4000 at 57600 baud with a serial cable from COM2 on the remote PC and COM1 on the 4000, enter the following command on the 4000:

```
TRANSFER  D:\DEMO.EXE /R /V /B57600
```

Then enter the following command on the remote PC:

```
TRANSFER  C:\DEMO\DEMO.EXE /S /V
/COM2 /B57600
```

To receive a file named D:\MYAPP.EXE from the 4000 and name it C:\APPS\MYAPP2.EXE on the remote PC over a serial cable connected to COM1 on both systems at 9600 baud, enter the following command on the 4000:

```
TRANSFER  D:\MYAPP.EXE /S
```

Then enter the following command on the remote PC:

```
TRANSFER  C:\APPS\MYAPP2.EXE
```

REMARKS: The TRANSFER command communicates with other XMODEM compatible file transfer programs.

The serial port on the 4000 requires a null modem adapter when connected to a serial port on the remote PC. See the section, *Serial Port*, in this manual for more information.

The maximum baud rate is dependent on the processor speeds of the remote PC and the 4000.

The received file size is rounded up to the nearest 128 byte boundary.

SEE ALSO: DISKSAVE.EXE, DISKSEND.EXE

VDISK.SYS

VDISK.SYS Device Driver

PURPOSE: This device driver allows the user to use memory as a disk.

SYNTAX: **DEVICE= VDISK** [*size* [*secs*[*dirs*]]] [/**E**] [/**NOTIFEXT**]

REMARKS: VDISK allows the user to partition some of the computer's memory as a disk. This disk is called a RAM disk or Virtual Disk. A RAM disk is much faster than either a floppy or hard disk. The RAM drive can use either standard DOS program memory or extended memory (above 1 MB) for the disk.

Any data on the VDISK is lost when the system power is turned off.

The *size* argument specifies the size of the VDISK in kilo (K) bytes. The default is 64K if base memory is selected. Otherwise, if /E is entered, then the size of the VDISK is all available extended memory (size is 64K smaller if DOS is loaded HIGH). The memory selected will be allocated from the DOS memory pool, decreasing the amount of memory available for programs, unless the extended memory switch is used.

The *secs* argument specifies the sector size in bytes. The default is 512 bytes per sector. This value must be 128, 256, 512 or 1024. All other values are not valid and the default of 512 bytes will be used.

The *dirs* argument specifies the number of root directory entries. The default is 64 directory entries. There may be any number of root directory entries between 2 and 1024. If an odd number is given, it will be rounded up to the nearest multiple of 16, in order to fill the entire sector.

The /E argument causes VDISK to use extended memory (memory above the 1 MB boundary) instead of DOS program memory for the disk.

The /NOTIFEXT argument causes the virtual drive to not be installed if extended memory exists.

NOTE: Interrupts are turned off during the transfer of data from extended memory to conventional memory.

The VDISK increases the resident size of DOS.

EXAMPLE 1: `DEVICE=VDISK.SYS`

The above example builds a 64K RAM disk in DOS memory.

EXAMPLE 2: `DEVICE=C:\DOS\VDISK.SYS 220 /E`

This example builds a 220K RAM disk in extended memory. The VDISK device driver is loaded from the C: drive and the \DOS directory. VDISK assumes the default 512 byte sector size, and 64 directory entries.

EXAMPLE 3: `DEVICE=VDISK.SYS 45 128 18`

The above example builds a 45K RAM disk in DOS memory. There will be 128 byte sectors and 18 root directory entries.

EXAMPLE 4: `DEVICE=VDISK.SYS /E`

On a 2 MB system, the above example allocates a 1024K drive in extended memory (960K is allocated if DOS is loaded HIGH).

This page intentionally left blank.

PROGRAMMING STANDARD EPROMS

The 4000 SSD1 socket accepts EPROMs as well as flash memory. You must program the EPROM before installing it on the 4000 card, since there is no on–card programmer.

To program an EPROM

1. Depending upon the type of image file you want to create, do one of the following:

   A. To create an image file of up to 1 MB for the SSD1 EPROM from local drive A, enter:

   ```
   DISKSAVE  /FA  /DSSD1  /S1M
   ```

   B. To create an image file of up to 512K for SSD1 from a local subdirectory named C:\TEST, enter:

   ```
   DISKSAVE  C:\TEST  /DSSD1  /S512K
   ```

2. Install the EPROM into the programmer and program the chip using the file SSD1.IMG.

CUSTOM COMMUNICATION CABLE

The 4000 card requires an RS–232 serial communications cable to interface to the PC. If you are not using a VTC series cable, you can make your own communications cable.

NOTE: This is a simple null modem cable. RxD and TxD are crossed. PC SmartLINK IV does not require signals other than transmit, receive and ground. If another terminal package is used, other signals, such as RTS, CTS, DSR and DTR may have to be tied to one another at the destop PC to provide for a full null modem cable.

1. Determine if your PC requires a male or female connector.

2. Refer to the following table for cable connections for the 4000:

Custom RS-232 Cable				
COM1/COM2	**Micro PC Signal Direction**	**DB-25**	**DB-9**	**PC Signal**
1	DCD Input	8	1	DCD
2	DSR Input	6	6	DSR
3	RxD Input	2	3	TxD
4	RTS Output	4	7	RTS
5	TxD Output	3	2	RxD
6	CTS Input	5	8	CTS
7	DTR Output	20	4	DTR
8	RI Input	22	9	RI
9	Gnd	7	5	Gnd
10	+5	NC	NC	

POWER SUPPLY

Octagon supplies are designed to ramp up fast (less than 50 ms), discharge fast on power down and to regulate properly under a no load condition.

Most desktop PC switching supplies are rated at 5V at 20A or more. Switching supplies usually requires a 20% load to operate properly, that is, 4A or more. Since a typical Micro PC system takes less than 2A, the desktop PC supply does not regulate properly. Output drift up to 6-7V and/or 7-8 voltage spikes have been reported. If the power supply comes up slowly (that is, longer than 50 ms), the sequencing of ICs on the board may be out of sync, thus, causing the system to lock up.

If large output capacitors are used, powering the system down and then up may lock up the Micro PC. If the power supply does not drain below 0.7V, the CMOS components on the Micro PC will act like diodes and forward bias.

If using a non-Octagon supply, select a supply that has a low or no minimum load requirement, comes up in less than 50 ms and discharges quickly on power down.

UPLOADING FILES FROM THE 4000

The TRANSFER program is also used to upload files from the 4000 card to your PC for editing or debugging. To upload a file:

1. Make sure a serial link is established between your PC and the 4000.
2. Start PC SmartLINK on your PC.
3. Execute the TRANSFER program from the 4000 to send a file to your PC.

   4000C:\> **TRANSFER /COM1 /S <drive><path>** ***filename.ext***

   filename.ext is the name of the file on the 4000 which you are sending to your PC.

4. To receive the files from the 4000, execute the TRANSFER program from your PC using PC SmartLINK, for example:

   <ALT><U>
   filename.ext
   <ENTER>

   filename.ext is the name of the file on the PC which you are receiving from the 4000.

   Refer to the *PC SmartLINK User's Manual* for information on transferring files using the XMODEM protocol.

ASSIGNING DRIVE DESIGNATORS

ROM–DOS is a MS–DOS version 6.22 compatible operating system. Since it is stored in ROM, it is always present on power–up. During run time it requires only about 20K of RAM space if DOS is loaded high; 64K of RAM space if DOS is loaded low. When you boot from ROM–DOS in the BIOS socket, the system automatically assigns drive designators to the extended memory virtual drive and SSD1. However, if you boot from SSD1 or floppy/hard drive you must add the appropriate device drivers to your CONFIG.SYS file and copy the files to your boot drive in order to access the BIOS drive and the extended memory virtual drive.

NOTE: Even though you provide information about memory devices during setup, you must still define drivers for these devices in your CONFIG.SYS file. The following is an example listing of CONFIG.SYS entries for the device drivers included with the 4000. Each of these device drivers is discussed in greater detail in Appendix A, *Software Utilities*:

`DEVICE=HIMEM.SYS`	Load memory manager
`DOS=HIGH`	Load DOS in high memory if possible
`DEVICE=VDISK.SYS 136 /NOTIFEXT`	Access the virtual drive in base memory if extended memory does not exist
`DEVICE=VDISK.SYS /E`	Accesses the virtual drive in extended memory
`DEVICE=SSDDRIVE.SYS BIOS`	Accesses the BIOS drive
`DEVICE=SSDDRIVE.SYS SSD2`	Accesses the SSD2 drive

When your system boots up, the 4000 device drivers will be listed with their drive designations. When you boot from ROM–DOS in the BIOS drive, drives D–E are defined in the CONFIG.SYS file. The drives are designated as:

A: floppy disk
B: floppy disk
C: BIOS socket
D: virtual disk
E: SSD1
F: SSD2

If your system has a hard drive, drive C: (in the example above) becomes the hard drive and drives C–F are now designated as D–G.

When you boot from SSD1 with ROM–DOS, the drives are designated as:

A: floppy disk
B: floppy disk
C: SSD1
D: first driver in CONFIG.SYS
E: second driver in CONFIG.SYS

Example:

In the following example of bootup messages, the system boots from the BIOS drive with 1MB DRAM, 512K flash memory in SSD1 and 128K static RAM in SSD2. The system assigns the following drive designations:

```
VDISK V6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
  Extended memory present.

VDISK V6.22 (Revision 2.10)
Copyright (c) 1989-1995 Datalight, Inc.
  Formatting 384K XMS memory as drive D:
SSDDRIVE.SYS V1.00 Assigning SSD1 (512K) as drive E:
SSDDRIVE.SYS V1.00 Assigning SSD2 (128K) as drive F:
```

EXTENDED MEMORY

If there is 1 MB or more of DRAM in your system, you can bypass the memory driver and extend the available memory past 640K by using the following instructions. This assumes you are not using the extended memory for a virtual drive.

The memory window for the hardware EMS support is at D0000-DFFFF and is normally "shut" off. If you have off-card devices at this address, you cannot access the EMS memory.

NOTE: These instructions are written in 8086 assembly code.

Perform the following before your program accesses extended memory:

```
MOV DX, 21AH
MOV AL, 80H      ;set auto increment
OUT DX, AL

MOV DX, 218H
```

Bit 15 is enable for current page. Bit 14–0 are A23–A14. 40H=A20=100000. 41H=A20+A14=104000.

```
MOV AX, 8040H    ;first 16K starting at D000
OUT DX, AX

INC AX
OUT DX, AX       ;second 16K starting at D400

INC AX
OUT DX, AX       ;third 16K starting at D800

INC AX
OUT DX, AX       ;fourth 16K starting at DC00
```

Access the page by writing/reading through the EMS window:

```
MOV AX,0D000H
MOV ES,AX
```

(Sets ES to the window segment.)

```
XOR DI,DI
MOV ES:[DI],AH
```

(To store something in the window.)

```
MOV AH,ES:[DI]
```

(To retrieve something from the window.)

When your program has finished with the EMS memory:

```
MOV DX, 21AH
MOV AL, 80H       ;set auto increment for 218H/219H
OUT DX, AL

MOV DX, 218H
MOV AX, 0         ;make bit 15=0 to disable EMS page
OUT DX, AX        ;disable first 16K page
OUT DX, AX        ;disable second 16K page
OUT DX, AX        ;disable third 16K page
OUT DX, AX        ;disable fourth 16K page
```

INTERRUPTS

Even though the 4000 employs an 8-bit PC/XT style bus, it supports four additional interrupts: IRQ10, IRQ11, IRQ14 and IRQ15 which are normally found in a full 16-bit AT style bus. This allows applications using expansion cards such as the Micro PC 5540 Multifunction Card or the Micro PC 5300 Counter Timer Card to use interrupts which have previously conflicted with the CPU. For example, using the 5540 with the 4000 allows you to support four COM port interrupts at one time: COM1 (IRQ4) and COM2 (IRQ3) on the 4000 and COM3 (IRQ10) and COM4 (IRQ11) on the 5540 card.

NOTE: The 5540 will still address COM3 as IRQ4 and COM4 as IRQ3 on the bus; the W3 jumper on the 4000 simply redirects bus IRQs to selected CPU IRQs.

IRQ10, IRQ11 and IRQ14 are jumper selectable at W3 on the 4000. IRQ10 on the 4000 is jumper selectable to bus IRQ3, IRQ11 on the 4000 is jumper selectable to bus IRQ4, and IRQ5 on the 4000 is jumper selectable to IRQ14.

W3: Interrupt Select		
Pins Jumpered	**Bus IRQ**	**CPU IRQ**
[11-12]*	IRQ5	IRQ5
[13-14]	IRQ5	IRQ14
[15-16]	IRQ4	IRQ4
[17-18]	IRQ4	IRQ11
[19-20]	IRQ3	IRQ3
[21-22]	IRQ3	IRQ10

* = default

The 4000 also supports any operating system which requires the standard AT IDE disk device interrupt (IRQ14). This includes QNX, Novell, Windows and others. This is accomplished by redirecting bus IRQ5 to CPU IRQ14.

Remote Interrupt

The 4000 also provides for a remote, opto-isolated interrupt, IRQ15. The opto-isolation allows the interrupt line to extend up to 50 feet from the card. A 5V signal applied to the optical interrupt inputs (GND to J10-2, +5V to J10-1) will generate IRQ15 if W4[1-2] is installed. Noise filtering is built-in. The isolation from the system ground is 500V. The remote interrupt is accessed at J10[3-4]. Refer to Figure 2-1 for the location of J10.

W4: IRQ15 Opto Interrupt Enable	
Pins Jumpered	**Description**
[1-2]	IRQ15 connected to opto interrupt input
None*	IRQ15 disconnected from opto interrupt input

* = default

J10: Opto-Isolated Reset & Interrupt	
Pin #	**Signal**
1	+ IRQ
2	- IRQ
3	- Reset
4	+ Reset

J10 Opto-isolated Reset and Interrupt, 4-pin Mating Connector:
Connector housing: DuPont BERG #65039-033
Crimp terminals: DuPont BERG #48235-000

Refer to Chapter 8, *Watchdog Timer, Powerfail & Hardware Reset*, for more information on using the opto-isolated reset, J10[3-4].

Disabling Interrupts

The PC Bus does not allow shared interrupts on the bus. You can, however, disable the COM1 and COM2 interrupts (IRQ4 and IRQ3) to allow for other devices which use these interrupts. If COM1 is the console, its interrupt (IRQ4) is in use. COM2 (IRQ3) is not used by the BIOS.

WARRANTY

Octagon Systems Corporation (Octagon), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the current established warranty period. Octagon's obligation under this warranty shall not arise until Buyer returns the defective product, freight prepaid to Octagon's facility or another specified location. Octagon's only responsibility under this warranty is, at its option, to replace or repair, free of charge, any defective component part of such products.

LIMITATIONS ON WARRANTY

The warranty set forth above does not extend to and shall not apply to:

1. Products, including software, which have been repaired or altered by other than Octagon personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Octagon.
2. Products which have been subject to power supply reversal, misuse, neglect, accident, or improper installation.
3. The design, capability, capacity, or suitability for use of the Software. Software is licensed on an "AS IS" basis without warranty.

The warranty and remedies set forth above are in lieu of all other warranties expressed or implied, oral or written, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose, which Octagon specifically disclaims. Octagon neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Octagon shall have no liability for incidental or consequential damages of any kind arising out of the sale, delay in delivery, installation, or use of its products.

SERVICE POLICY

1. Octagon's goal is to ship your product within 10 working days of receipt.
2. If a product should fail during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.
3. Customers that return products for repairs, within the warranty period, and the product is found to be free of defect, may be liable for the minimum current repair charge.

RETURNING A PRODUCT FOR REPAIR

Upon determining that repair services are required, the customer must:

1. Obtain an RMA (Return Material Authorization) number from the Customer Service Department, 303-430–1500.
2. If the request is for an out of warranty repair, a purchase order number or other acceptable information must be supplied by the customer.
3. Include a list of problems encountered along with your name, address, telephone, and RMA number.
4. Carefully package the product in an antistatic bag. (Failure to package in antistatic material will VOID all warranties.) Then package in a safe container for shipping.
5. Write RMA number on the outside of the box.
6. For products under warranty, the customer pays for shipping to Octagon. Octagon pays for shipping back to customer.
7. Other conditions and limitations may apply to international shipments.

NOTE: PRODUCTS RETURNED TO OCTAGON FREIGHT COLLECT OR WITHOUT AN RMA NUMBER CANNOT BE ACCEPTED AND WILL BE RETURNED FREIGHT COLLECT.

RETURNS

There will be a 15% restocking charge on returned product that is unopened and unused, if Octagon accepts such a return. Returns will not be accepted 30 days after purchase. Opened and/or used products, non-standard products, software and printed materials are not returnable without prior written agreement.

GOVERNING LAW

This agreement is made in, governed by and shall be construed in accordance with the laws of the State of Colorado.

The information in this manual is provided for reference only. Octagon does not assume any liability arising out of the application or use of the information or products described in this manual. This manual may contain or reference information and products protected by copyrights or patents. No license is conveyed under the rights of Octagon or others.